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The Outlook

A Mediterranean Armageddon?

THE opinion of Field Marshal Smuts on probable developments of strategy always commands respect. He believes that the final great struggle in the war will be fought out in the Mediterranean, and if he is of that opinion it is not to be lightly dismissed. World strategy does not change with the development of weapons, and we may recall that the name of Alexandria commemorates the first European conqueror of the East, that the Battle of the Nile stopped Napoleon's drive in that direction, and that for many centuries the destinies of the civilised world hung round the two Capital cities of Rome and Constantinople. Kaiser Wilhelm always had his eyes fixed on the roads to the East, and at the moment Hitler is painfully battling his way in that direction.

Of course, Africa is a starting point for the West as well as for the East, and Dakar looms large among the possible developments of the present German plans. This gives the United States a very live interest in campaigns in the Mediterranean.

It is perhaps a coincidence, but certainly a very interesting one, that while the South African Prime Minister was making his prophecies, President Roosevelt should announce that an agreement had been signed with Pan American Airways for the delivery of martial aircraft to the British forces in the Middle East by way of West Africa. Some months ago it was announced that a proportion of the United States exported aircraft were sent to that part of the world, apparently on board ships. Now the big bombers are to be flown across the Atlantic. From British West Africa to Cairo an organised airway has been in operation by British Overseas Airways. In peacetime it was regarded as a sideshow, but now it assumes strategic importance, and the American pilots are to fly their charges along it. They may even take some on from Egypt to Russia, holding in reserve the Behring Sea-Siberian route.

The Middle East Command has done wonders with small supplies of aircraft and air forces, but it felt its shortage badly during the campaign in Greece. The Prime Minister has said that that shortage was due to the difficulties of finding shipping to take the aircraft to that front. The American plan will short-circuit that difficulty, at least so far as heavy bombers are concerned. The fighter position, which was once rather serious, especially at Malta, has now been mainly put right, and American ships can take Tomahawks and other fighters up the Red Sea to Suez. Heavy bombers take up more space on ships, and delivery by air is the ideal solution. So this latest plan is very welcome, and it encourages us to face a possible Armageddon in the Mediterranean with increased confidence.

Lease-lend and Beg-borrow

BEFORE the war there were only a few people in England who believed in the value of air transport to the British Commonwealth. Their efforts to communicate their belief in and enthusiasm for air transport to other people were not very successful, and among politicians the campaign yielded particularly barren results. The attempt to prove the value of air transport was based largely on the facility which it confers on commerce for the fast movement of personnel, mail and freight. The other national value which it has is as potential war transport, for the modern nation at war

requires many airliners for the movements of its high officials, its air force personnel and its parachute troops, and also needs established airways, such as that from West Africa to Egypt.

Probably all thoughtful people will agree that air transport has now completely proved its two claims to national usefulness, and perhaps the memory of this will be carried over into the peace which must finally come. Air transport must be raised to its proper status in the affairs of the nation if a repetition of the former mistakes is to be avoided. These former mistakes have led us into the present regrettable position of being quite unable to supply our own requirements in air transport—and we are begging and borrowing from the airlines and the manufacturing industry of the United States in our efforts to make good our own deficiencies.

In 1940 we bought 43 transports from the American airlines; in the first half of this year we bought 20 more. But our latest request is for another 24 Douglas DC-3s and 12 of them were handed over to us on July 12th. But whether we shall receive the other 12 is very doubtful, as the airline companies point out that they must deal with ever-increasing traffic and need these airliners. The validity of their statement is fully realised, at least by *Flight*, as, though we in this country think of the States as having a very well-developed air transport system, they have a total of only 300 airliners. We have fewer than that—how few would surprise most people.

We have every sympathy with the U.S. airlines in their complaint, and would be against any such request for airliners being made to them if it were not for the urgency of the war situation and the fact that the interests of U.S.A. and ourselves are so bound up together. As it is, we feel that we can only ask our representatives in U.S.A. not to press the matter too closely if it can possibly be avoided, as the serious curtailment of the traffic-carrying capacity of the airlines would cause friction in the American war machine. Some consideration should also be given to the fact that, while we ask for airliners, bombers are stacked up on American aerodromes, according to the statements of at least two leading American aviation papers.

A Pride of Lions

MR. FRASER, Premier of New Zealand, has been in Great Britain for some time. Mr. Menzies, Premier of Australia, has been here and is contemplating a second visit. Field Marshal Smuts cannot get nearer to us than Cairo, but there he met a member of the War Cabinet, Mr. Lyttelton. Now Mr. Mackenzie King, Premier of Canada, has flown the Atlantic in a bomber to take part in discussions for the conduct of the war. The British Lion and all the lion cubs are at one in this great struggle, for tribulation draws men closer together than any other influence can do.

The Dominions cannot easily spare their leaders from the seat of their own affairs for long, and if air transport had not been available it is doubtful whether Mr. Mackenzie King could have afforded the time to give Mr. Churchill the great advantage of a meeting and consultation. Moreover, air transport is now the safest means of travel. The Navy took Mr. Churchill safely to his meeting with President Roosevelt, but the Navy is very busy and cannot always spare ships for such matters.

DEMOCRATIC CO-OPERATION : An air crew of the Royal Dutch Naval Air Service emplaning in an American-built Lockheed Hudson for a patrol with the R.A.F. Coastal Command. Points of interest are, the beam-firing Vickers K gun ; the Williamson oblique camera mounted in the adjacent window, and the basket of pigeons in the charge of the wireless operator. The bulge on the inside of the door contains the collapsible dinghy.

POSSIBILITIES of JET PROPULSION

Engineers in Many Countries Grapple with Fascinating Problem Some Original Aircraft Designs and Layouts

By G. GEOFFREY SMITH

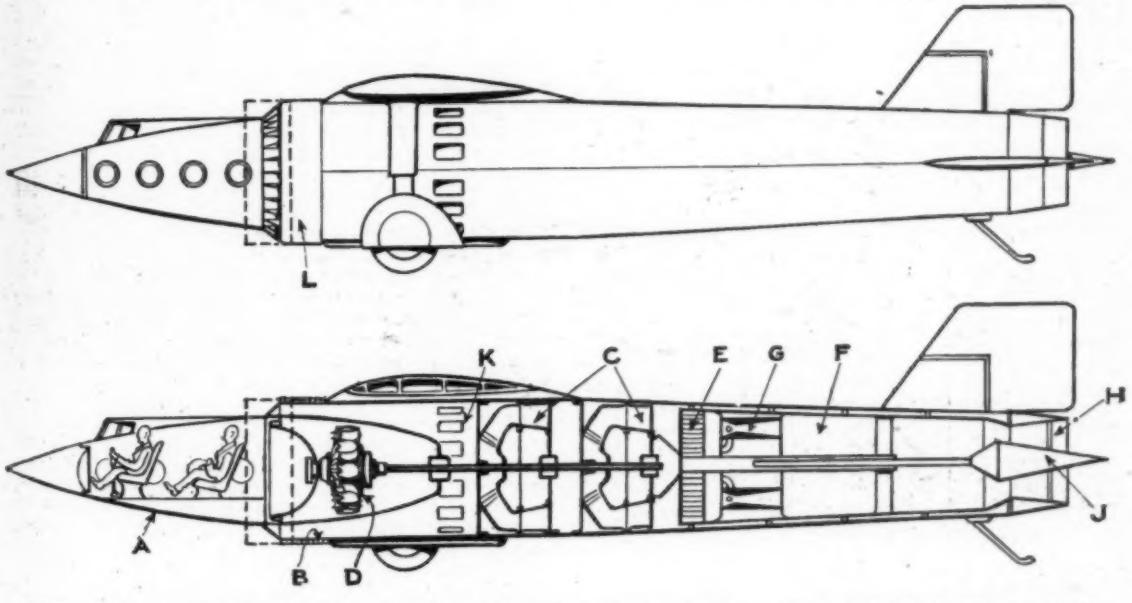
PRIME movers alternative to the engine-airscrew combination are the subject of intense study and experiment in various countries. Comparatively little is known of the progress with such aircraft units, but the accompanying article, with drawings by "Flight," indicates the line of development being followed by Germany and Italy in this new field of engineering. Other jet propulsion units will be reviewed in succeeding articles.

THE idea of an aeroplane being propelled through the air without the aid of an airscrew strikes one at first as fantastic. Yet scientists and engine designers the world over have been at work for years past in an endeavour to evolve a prime mover that will supersede the internal-combustion engine—airscrew combination as we know it—and at the same time achieve progress in directions where at present development work is temporarily checked. Internal combustion turbines and rocket propulsion have been much in the public eye in discussions of late years. Over the last thirty years, too, jet propulsion has been the subject of intense study, many patents and many experiments, not to say many disappointments. We have examined the projects of inventors in Great Britain, Sweden, France Germany, Italy, U.S.A. and Switzerland, including material issued from time to time by R. T. P. of the Air Ministry. It is good to know that British engineers quite early began investigations into the possibilities of applying jet propulsion systems to aircraft. It seems clear from the advanced state of these designs and the progress revealed by the passage of time that we are on the eve of successful application of jet impulse reaction to modern aircraft. Jet reaction is probably the oldest method of converting heat into mechanical energy. It is the principle employed in the legendary eolipile of Hero; the hollow sphere rotated on an axle by the reaction of jets of steam issuing from tangential pipes A wheeled carriage propelled by a fixed sphere with rearwardly-directed nozzles is well known for classroom demonstration.

In what is probably its simplest form of construction the plant comprises a turbo-compressor and a gas turbine on a common shaft. The compressor delivers air under pressure to a chamber into which fuel is injected. Pressure drop on re-expansion takes place in two stages: at the turbine and at the discharge nozzles. Of course, auxiliary equipment will be necessary for starting, fuel injection and lubrication.

There are, however, a number of possible alternative arrangements. A reciprocating engine may be employed to drive the turbo-compressor. In this case a portion of the air delivered by the compressor is used to scavenge and charge the engine cylinders into which fuel is injected. The other portion of the air cools the engine cylinders, thus absorbing heat, and is mixed with the engine exhaust in a final expansion chamber. Additional fuel could be injected into the final expansion chamber, although its use would be relatively inefficient owing to the lowered pressure. Such a system could possibly be of advantage in providing boost for take-off or for emergency power or speed in the air.

A turbo- or centrifugal compressor is not an essential feature. A survey of patent specifications shows that schemes have been evolved utilising combined engines and compressors of reciprocating type. Some are of the air-cushioned, free-piston type having no crankshaft or connecting rods. It has even been suggested to use the heat of the compressed air to raise steam in a boiler, possibly with the assistance of a combustible fuel, for a steam turbine driving the compressor. This would scarcely seem to be a practical arrangement for aircraft propulsion, however, as it would be necessary to carry a heavy load of



A Campini design of high-altitude craft for operation at either sub- or super-sonic speeds. The control cabin is pressure charged. Weighing 8,800lb., a Campini type was flown for 10 minutes on August 27, 1940, at the Forlanini Aerodrome, Milan.

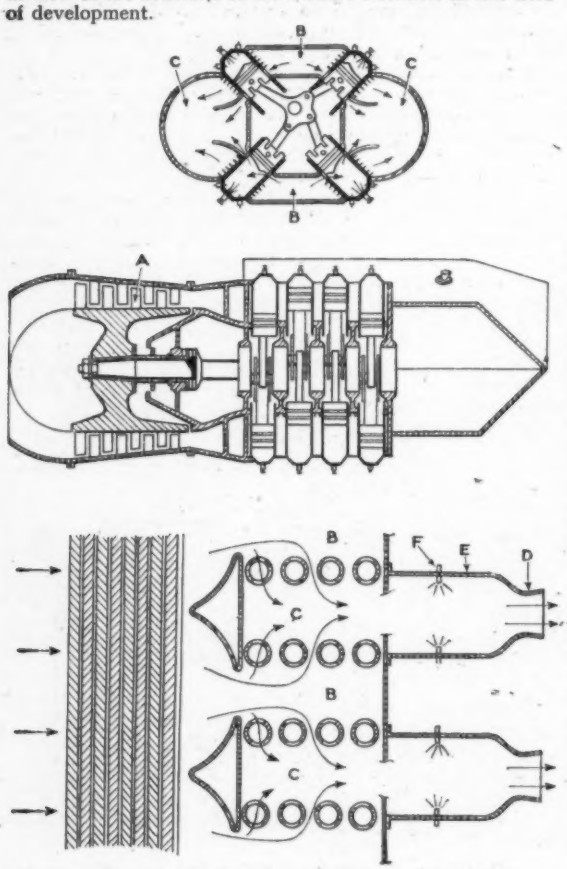
water or a condensing plant. In the latter case some energy in the exhaust steam would be lost to propulsive effort.

In 1939 the German aviation journal *Flugsport* issued a review of all designs dealing with thermal jet propulsion, by the German writer Gohlke. The article embodied many illustrations and leading particulars of the chief designs, including certain English patents.

Early French Designs

As in many other matters aeronautical, France took a leading part in attempts to adapt exhaust efflux to the propulsion of aircraft, Marconnet and Lorin having devised such schemes and explained their aims and objects as far back as 1909. Marconnet gave examples of a method in which the compression is effected by means of compressors or blowers; he differentiated at that early stage between systems with constant pressure and those with constant volume. Jet impulse reaction—that is, thrust provided by the extremely rapid ejection of gases from a suitably shaped nozzle—has progressed a long way in recent years.

Two months ago Lt. Col. J. T. C. Moore-Brabazon threw out a hint to a meeting of members of the Institution of Automobile Engineers, when he urged more original thought in design and experimentation, that future prime movers might be developed from an entirely different angle—something basically different from the present power plants. Possibly the old problem of jet propulsion was in his mind in view of the activities of the world's scientists in this field of development.



Junkers jet reaction plant employing a multi-bank, air-cooled, two-stroke engine to drive the turbo-compressor. Additional fuel may be injected into the final expansion chambers to increase the propulsive effort.

Jet Reaction—How It Works

This briefly is how the system works. Air is the working fluid. Fuel, which for practical purposes will be any of the natural or synthetic liquid hydrocarbons which we use in engines to-day, is required for the addition of heat to the air. Air is drawn in, compressed into a heating chamber, and heat is added by the combustion of fuel. On re-expansion, sufficient energy is taken by a motive unit to drive the compressor, and the air, still capable of expansion, discharges to atmosphere as a high-velocity efflux from a nozzle or nozzles. This efflux, or jet, produces a reaction, in the nature of an axial thrust on the plant, which constitutes the propulsive effort.

What is the real attraction of jet reaction units? Scientists claim that in its developed state it will provide a powerful thrust in proportion to its weight and make possible a higher speed than has been obtained up to the present with accepted type engines. Its efficiency should not be lowered by the reduced density of the air at high altitudes and may even be enhanced owing to the low temperature prevailing in the upper atmosphere. Furthermore, a complete plant will be of relatively simple construction, of convenient external form, and will operate with any fuel now in use.

Means of regulation may include fuel control, gas flow control, control of compressor speed, or control of the power unit driving the compressor. For manœuvring the craft, the emission nozzle may be directionally controlled. One or more complete units may be employed on a single aircraft (a multi-unit design will be shown in our illustrations) and selectively operated either singly or in unison. When units are grouped, certain functions may be interdependent. For example, one turbine or reciprocating engine may drive the compressors for two units.

Italian Projects

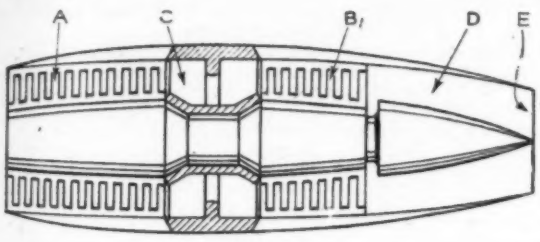
On August 27th of last year, according to the *Popolo d'Italia*, a high-speed Italian aircraft with jet propulsion to designs evolved by Engineer S. Campini, of the Caproni organisation (during its development frequently referred to), made a successful flight of ten minutes' duration from the Forlanini aerodrome, Milan, in the presence of General Alberto Briganti, Commander of No. 1 Air Zone. The particulars of the machine quoted in a translation by the Ministry of Aircraft Production (R.T.P.) stated that the machine was built entirely of metal, had a gross weight of 8,800 lb., retractable landing gear and a pressure cabin. The machine was driven solely by the reaction of ejected gases, and was claimed to be the prelude to a revolution in the design of aircraft and power plant installations. The note added that Campini's work had finally led to the development of a power plant whose efficiency is not below that of the engine-airscrew combination, even at conventional speeds.

The report in the *Popolo d'Italia* gave no details of the design of the propulsion plant, but probably this followed the lines suggested by Campini in 1932. In the projected design, illustrated on the previous page, Campini sought to employ jet propulsion for both sub-sonic and supersonic speeds. The cabin, A, is of ovoid form and constructed as a pressure unit for high-altitude operation. Air is admitted where the annular space between the cabin, A, and the enshrouding cylinder, B, has its smallest cross-section. This space widens out to the rear in order to convert the kinetic energy of the air into pressure energy. This compressed air then passes through a two-stage centrifugal compressor, C, driven by a radial engine, D, or possibly a gas turbine. Beyond the compressor it passes a radiator, E, which also acts as a rectifier, into the wide combustion space, F. Here, in an annular channel, G, of venturi shape, the air is supplied with fuel, and, after expansion, discharges through the nozzle, H. The nozzle unit is

JET PROPULSION

arranged to swivel, and the cross-sectional area may be varied by means of the cone, J. On starting, there will be a negative pressure in the inlet chamber between the cabin and the enshrouding ring, and air can be admitted by the displacement of controlled lateral orifices, K.

The air-admission arrangement outlined above is that employed for sub-sonic speeds. If the speed of flight is increased to a super-sonic velocity, a ring, L, is moved forward beyond the former mouth, as indicated by the dotted lines. The relative wind now enters a funnel which first converges and then widens, thereby taking account of the peculiar conditions of flow which are associated with super-sonic velocities.



Streamlined Junkers propulsion unit. Fuel is injected into the combustion chamber between the compressor and the gas turbine. The gas-flow through the turbine and the discharge nozzle is maintained at approximately the same sub-sonic velocity.

Some German Experiments

Germany, and the Junkers Company in particular, is also conducting investigations. Of the two Junkers' projects illustrated, one relates to a plant employing a multi-bank, radial, two-stroke engine as the driving unit for the turbo-compressor. Usually in plant of this type a portion of the air delivered by the compressor is utilised to charge the engine cylinders. The exhaust gases from the engine, and the by-passed major portion of the air, are mixed adjacent to the discharge nozzle or nozzles. Losses are occasioned by such a system in the mixing process as, although the mass leaving the nozzle is increased, the velocity is reduced. To avoid this defect the major portion of the air is delivered to a special mixing chamber, in which the exhaust gases are added to raise the pressure before transference to the discharge nozzle.

Referring to the drawings, the air is forced by the compressor, A, into passages, B, between opposite pairs of cylinder banks, from which a portion of the supply is taken as scavenging and charging air for the cylinders. The remainder passes round the cylinders as a cooling medium into the mixing chambers, C, arranged between the cylinder banks alternate to the passages, B. Into these chambers the exhaust gases are delivered to mix with the by-passed air, which has been pre-heated by the cylinder walls. From these chambers the mixture expands to the outer air by way of nozzles, D. To enable the propulsive effort to be increased, combustion chambers, E, into which additional fuel can be introduced through injectors, F, are provided between the mixing chambers and the nozzles. The air flow through the complete unit is shown diagrammatically in the plane projection of a longitudinal section of the plant.

Although there may be some immediate advantage in employing a reciprocating engine, the performance and reliability of which can be calculated with accuracy from accumulated data, it would seem that a gas turbine is particularly suitable for this work. The Junkers Company have proposed an attractive plant of this type. Despite the somewhat ambitious schemes of, for example, their Italian allies, this company is anxious to avoid the attainment of super-sonic speeds, not only of the aircraft, but even of the air flowing through the plant. With admirable caution they admit that such speeds introduce problems of an exceedingly complex character of which there is as yet but scanty knowledge. In the main the data available are related to ballistics and the flight of projectiles.

Optimum Velocity

With the type of plant shown diagrammatically, comprising a gas turbine and a turbo-compressor on a common shaft, the selection of a suitable terminal velocity at which the gases of combustion issue from the nozzle is of great importance. If the velocity be too low the gas turbine will of necessity be of large dimensions. Should the velocity be excessive, that is, above the speed of sound, it is expected that, with our present limited knowledge of super-sonic phenomena, undue losses would be experienced and a low degree of efficiency obtained. Accordingly, for practical purposes, the optimum velocity is regarded as being as high as possible, but below the speed of sound. The selection of such a speed enables the annular exhaust aperture of the turbine to be merged into the discharge nozzle under known or ascertainable streamline conditions. Furthermore, this permits the outer casing also to follow a practical streamlined outline.

If the conduit from the gas turbine to the discharge orifice is reduced in the direction of flow, the gas velocity through the turbine is lowered, and this unit must be made unduly large. On the other hand, if the conduit is enlarged in cross-section up to its outlet, an excessive terminal gas velocity may be attained which, if of the order of the speed of sound, is attended by unfavourable conditions of flow. Accordingly, it is proposed to maintain the discharge orifice at about the same dimensions as that of the gas turbine to avoid such adverse effects. The same effect, promoting good flow conditions internally and making possible an efficient exterior shape, can be obtained if any modification of the discharge aperture, whether an increase or decrease, is held within a narrow limit of approximately 3 per cent.

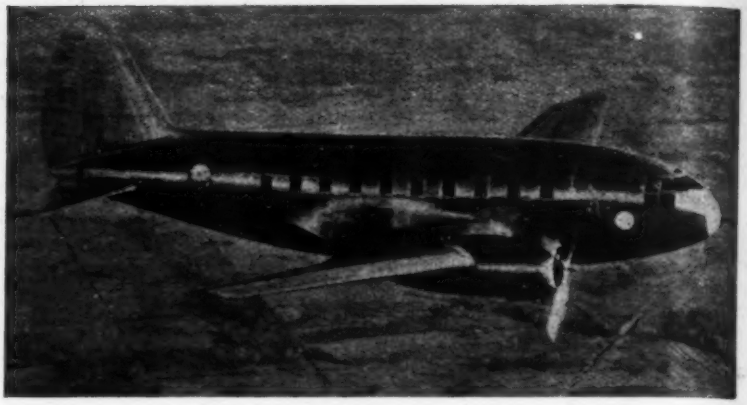
The schematic drawing shows a compressor, A, driven by a gas turbine, B. Air from the compressor is delivered to the combustion chamber, C, into which the fuel is injected. The combustion gases issuing from the turbine flow through an annular conduit, D, to the discharge orifice, E, with a velocity slightly lower than that of sound. The area of orifice, E, is calculated to be about the same as that of the exhaust aperture of the turbine, and the whole plant is arranged in a streamlined casing.

A further article dealing with Jet Propulsion of Aircraft will appear in an early issue.

Vapour Lock at Altitude

BOILING of the petrol, so causing a vapour lock in the fuel system, is one of the problems which high altitude flight brings in its train. Reduction of the atmospheric pressure at altitude allows the fuel to vaporise at much lower temperatures than at round level pressures. To combat this, it is necessary to use a fuel with a low vapour pressure, increase the pressure within the fuel tank, or keep the temperature of the fuel low. The first method is not promising as it would then be necessary to use an auxiliary fuel for starting and also because high octane fuels with low vapour pressure are not readily available. The pressure inside the tank could be increased by applying a supercharge pressure, or by "self-supercharging," which consists in closing the tank vent just after the fuel has started to boil and so preventing it boiling at any greater altitude. With a fast-climbing fighter, it may be necessary to cool the fuel on the ground, otherwise the contents of the tank will still be near ground temperature after the fighter has risen to great altitude.

HERE AND THERE



THE BIG TWIN : Designed originally as a 36-passenger airliner, this new Curtiss-Wright, powered with two 14-cylinder Wright Cyclones, has been converted to a troop transport for 40 soldiers. It is the world's largest twin, weighing 38,000 lb. loaded and was described in *Flight* for January 11th, 1940. Designed first with twin fins and rudders, it has now been changed to a single.

President of Trans-Canada

MR. H. J. SYMINGTON, K.C., has been appointed president of Trans-Canada Airlines in succession to Mr. S. J. Hungerford, who has resigned. A specialist in corporation law, Mr. Symington has been a director of Canadian National Railways since 1936.

New Empire Scheme Trainer

THE Fairchild M-62 low-wing monoplane, which has been selected as the new trainer for the Empire Air Training Scheme in Canada, should be in use early in 1942. First deliveries will be from the American factory, as all Canadian factories are at present too fully occupied to take on any more production.

Lightweight Rayon Tyre

USING rayon cord for reinforcement, the Firestone Tyre and Rubber Company has recently developed a new aircraft tyre which, in size 17.00 × 16, is 14lb. lighter than the type previously made. This increase of 28lb. in the payload of an airliner is well worth while, but in addition the new tyre is reported to stand up to considerably more wear. United, American, Pennsylvania Central and Eastern Air Lines are all using it.

Air-minded Americans

WITH private flying necessarily at a standstill in this country it is of more than normal interest—and just a little envy-provoking—to read that in America the clubs and civil flying schools are busier than ever. *Civil Aeronautics Journal* discloses that between January 1st 1940, and January 1st, 1941, the total of certified civil pilots more than doubled itself with a rise from 31,264 to 63,113—an increase of 31,849—eloquent testimony to the enthusiasm for the Civil Pilot Training Programme. Incidentally women pilots in the last census totalled 2,145.

Probably due in part to its idyllic weather, California topped the list with a contribution of 8,285 towards the grand total, New York State being second with 4,863 certified pilots. Certified civil aircraft in the U.S. at the beginning of the present year was 17,351.

End of Canadian Associated Aircraft ?

AN opinion expressed by *Canadian Aviation* indicates that the close linking of the six manufacturing companies known as Canadian Associated Aircraft may be dissolved when the present order for Hampdens for Britain is completed. Boeing Aircraft of Canada and Canadian Vickers are preparing to make Catalina components and will later build the whole aircraft, which in this case is reported to be an amphibian. Production of the complete Catalinas is expected in 1943.

Aircraft Exports from U.S.

SOME 30 per cent. of the total value of America's aircraft industry has been exported during the past 30 years, according to figures recently published in *American Aviation*. The total value of aircraft, aero engines and other components sold abroad during this period is just over $562,000,000, and this includes 10,460 complete aircraft. The figures are vouched for by Irving H. Taylor, manager of the trade development department of the Aeronautical Chamber of Commerce.

Canada to Make Liberators

AN official announcement has been made, reports *Canadian Aviation*, that the Canadian Car and Foundry Co. will commence making Consolidated Liberators after it has finished its order for Hurricanes. The change-over should occur about the end of this year; in the meantime the factory is believed to be tooling-up in preparation.

NOT TOO OLD AT 40: Though the U.S. Army Air Corps "pursuit" specification P-40 is not the very latest, its most recent variation is the Curtiss Kittyhawk, known as the P-40D, and looks a very handy fighter. With the increasing power of the Allison V-1710 engine, the latest model of which has passed tests for a take-off rating of 1,325 h.p., the Kittyhawk should be little if anything behind our latest Spitfire.

Getting the Bird !

THERE is a good little story about a certain flying school in Saskatchewan where, it seems, rather too many pupils were forgetting the little matter of unfolding the undercarriage before restoring the aircraft to mother earth. The ground staff found, in consequence, that a certain unwelcome monotony was creeping into their job.

Then somebody had an idea and managed to obtain a photograph of a bird about to land with its legs extended. Prints of this were surreptitiously attached to the instrument panels of machines flown by the careless students with the caustic enquiry, "Look, you —— fool! The birds can do it; why can't you?"

First of a New Series

FRIEND or FOE ?

Tail Unit Design as an Aid to Identification

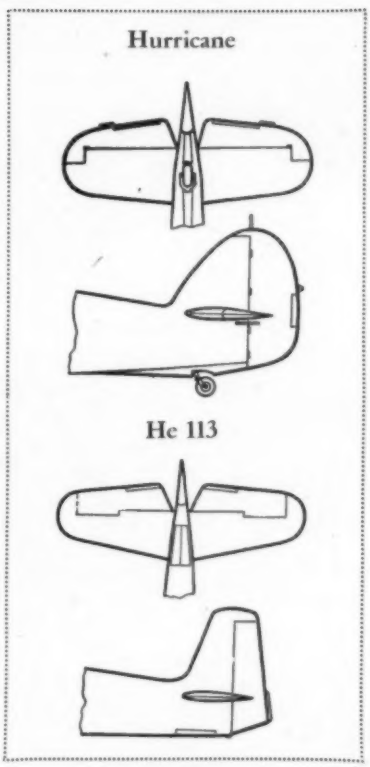
(Continuing a regular weekly series which commenced in *Flight* of January 9th, 1941, and incorporated 33 comparative studies in detailed points of identification)

HAWKER HURRICANE. Cantilever tailplane set just below base of fin. Rudder projects between elevators and extends down to bottom line of fuselage. Navigation light on rudder. Curved outline to all surfaces.

THIS week begins a new phase of the "Friend or Foe?" identification series. The first phase, just concluded, presented a total of 66 different types of military aircraft during 33 consecutive weeks. These were illustrated by three-quarter front views, accompanied by sets of general arrangement drawings showing front and side elevations and the plan from beneath. Identification of aircraft continues to be a subject of first importance and general interest, and *Flight's* correspondence files bear ample witness to the usefulness of its "Friend or Foe?" pages.

The new phase will continue to present current types from a different angle and one which brings tail design into prominence. Quite often a machine can be more readily identified by its empennage than by any other single feature, and it is easy to imagine circumstances in which the spotter may have to depend upon recognising a characteristic tail design in order to confirm identity. For that reason the normal G.A. drawings will be replaced by plan and elevation drawings of the tail-unit alone.

We begin this week with the Hawker Hurricane and Heinkel He 113. Both these tail groups are on the same general lines; that is, the tailplanes are cantilever and are mounted just below the base of the fins, and the rudders extend down between the elevators to the bottom line of the fuselages. But they can be distinguished from each other at a glance by the fact that the tail outlines of the British machine present a series of graceful curves, while those of the German fin and rudder are far more angular. This difference, while certainly a national characteristic in design, must not be regarded as anything like an infallible clue to nationality, for there are a number of exceptions on both sides, as will be seen in subsequent examples in this series.



All that can safely be said on this point, therefore, is that any machine seen to possess an angular outline to its tail assembly should at once be suspected of hostile origin until the spotter has had sufficient chance to identify it with certainty. This only applies, to any appreciable extent, to machines seen over this country or its adjacent waters; in the Middle East and Mediterranean theatres of war, where Italian aircraft are occasionally encountered (when a rear view is particularly likely!), the more artistic Latin temperament seldom indulges in aerial angularity.

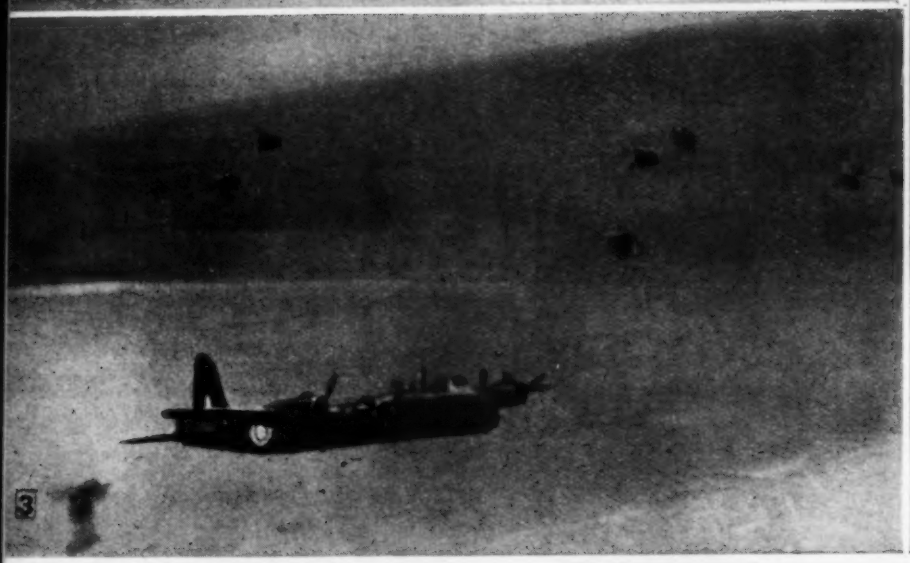
Certain detail differences will be observed from a study of the accompanying pictures. The Hurricane, for example, has a navigation light fitted to the extremity of its rudder and immediately below this is an inset trimming tab; each elevator, however, has a projecting tab. Probably because it is *never* safe for a German machine to display navigation lights at night—not even over its own territory, these days—no tail lamp adorns the rear of the Heinkel. In the fitting of trimming tabs the reverse method has been adopted on the German fighter, that on the rudder projecting and those on the elevators being inset on each side of the "bite." Yet another divergence is in tail-wheel design. That of the Hurricane is fixed (it retracted on earlier models), but a shallow fin, which acts to some extent as fairing, runs along the bottom of the fuselage from just aft of amidships to the base of the rudder post. The He 113 tail-wheel retracts completely.

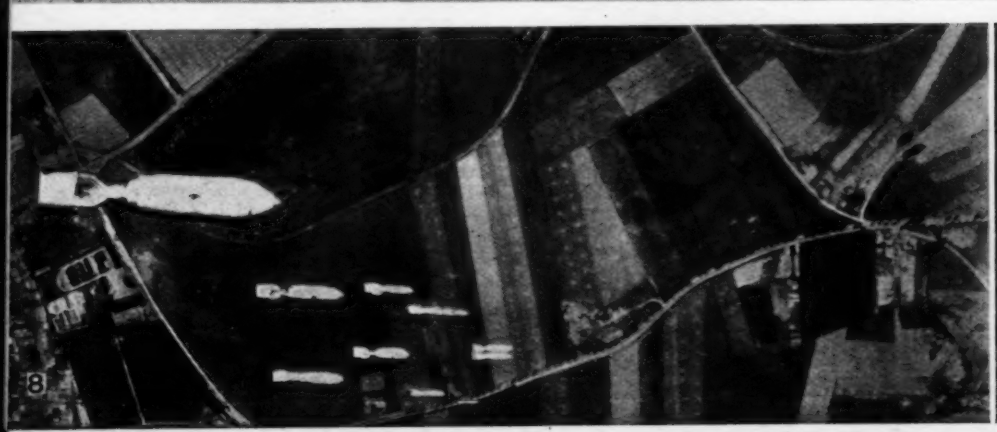
Next week: The Spitfire and the Me 109F.

HEINKEL He 113. General layout of the tail group is very similar to that of the Hurricane, but outlines suggest a series of straight lines and sharp corners instead of curves.

DAYLIGHT

A Pictorial Record of a R... Aircraft Factory at Meau... Meaulte is some...

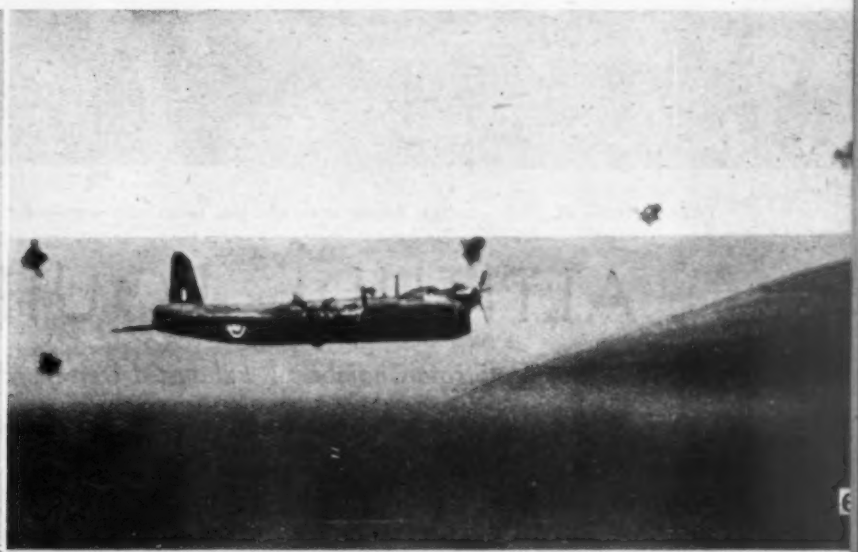


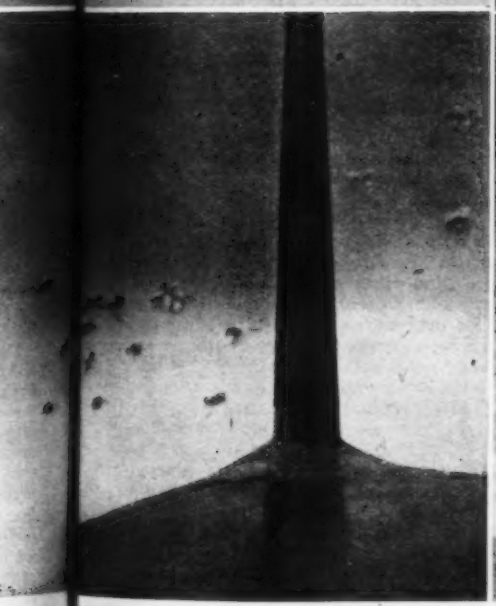


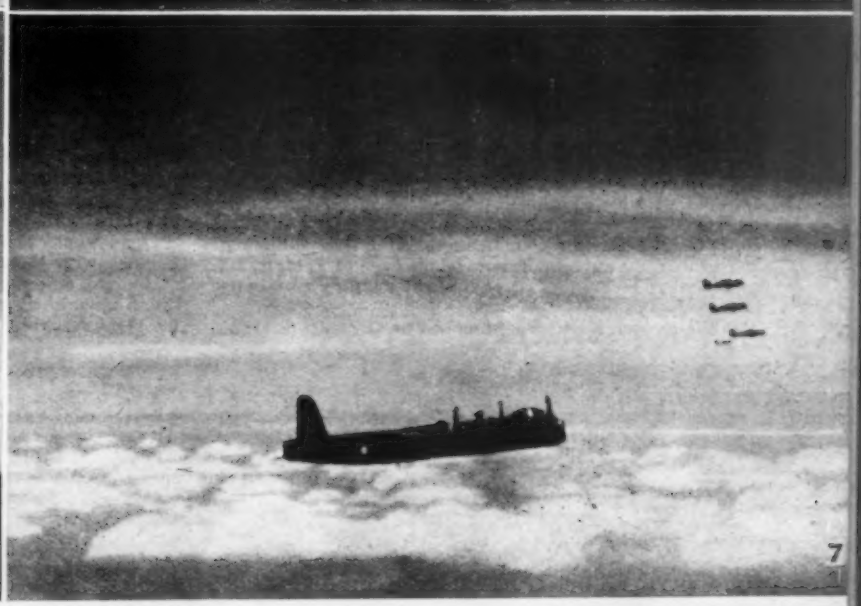
ATTACK

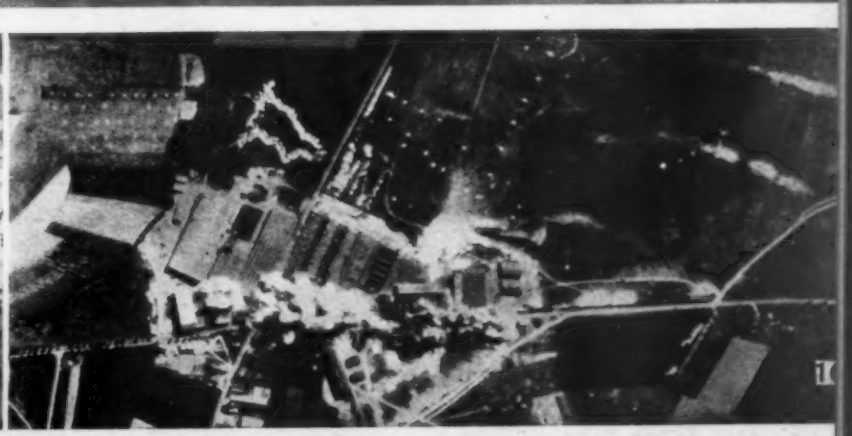
Short Stirlings on the Potez
ear Albert, in Northern France.
es from the Coast.

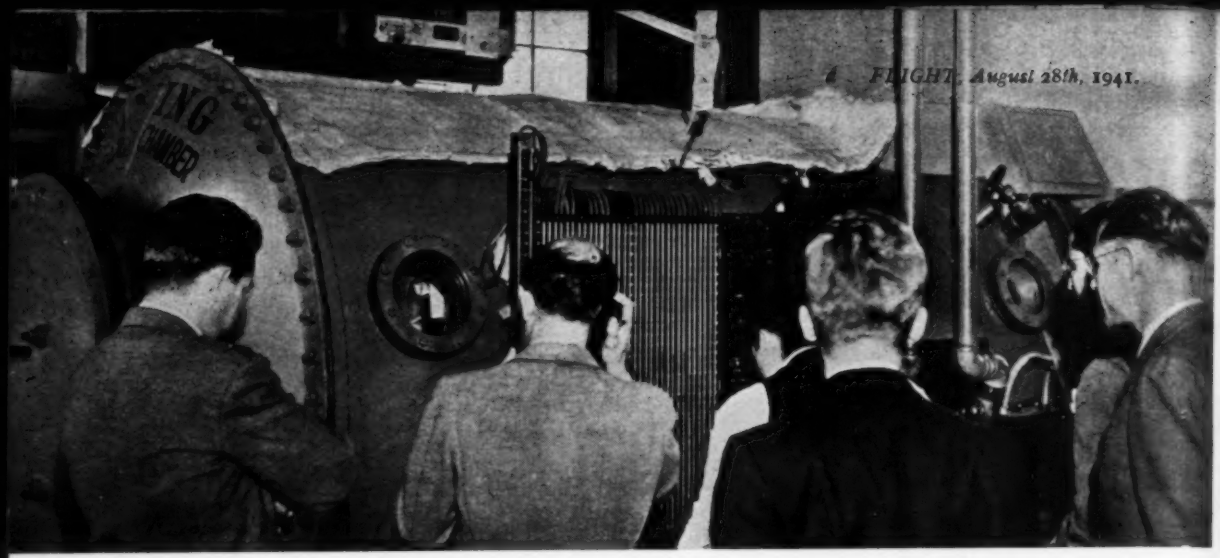
(1) THE RENDEZVOUS : Short Stirlings and Hurricanes forgather over the Kent coast. (2) OVER THE CHANNEL : The Hurricanes keep in close formation with their charges. (3) ACROSS THE FRENCH COAST: Enemy-occupied territory is reached and "flak" is encountered. (4) JINKING : To put off the German A.A. gunners' aim a Stirling resorts to evasive manœuvre. (5) OVER THE TARGET : A photograph taken from a Stirling as it penetrates the A.A. barrage on the run up to bomb the target. (6) HOMEWARD BOUND : The last of the A.A. shells burst as the bombers turn for home. (7) NEARLY HOME : Stirlings with their Hurricane escorts sight the English coast through the clouds. (8) BOMBS GONE, SIR : A salvo of bombs immediately after their release. (9) HALF-WAY DOWN : The bombs remain almost directly beneath the bomber. Note the target appearing at the right-hand side of the picture. (10) BULL'S-EYE : The salvo of bombs bursting on the main assembly hangars and offices.











LABORATORY FLIGHT. In this Boeing strato-chamber crews can be trained for high-altitude work up to 40,000 ft.

ALTITUDE EQUIPMENT

Boeing Strato-Chamber : Exhaust-driven Turbo-Supercharger

AS one would expect from the builders of the Fortress bombers, the Boeing Aircraft Company has studied the subject of high-altitude flight very closely. One aspect of this is the effect of height on the crew, and for this purpose the company has a large vessel which can be exhausted and cooled down to altitude conditions. This is known as the "strato-chamber." Research in flight also goes on and these tests are conducted by the Boeing flight and aerodynamics department under Edmund T. Allen, director, and Al Reed, chief test pilot. All the work is done in close liaison with the Mayo Laboratory of Aviation Medicine and also with the General Electric Company, developers of the turbo-superchargers with which the engines of the Fortress are equipped.

The problem in training crews for high-altitude work is two-fold. Proper equipment must be assembled from many sources and procedures must also be developed to guide crews in preparing for a flight, in handling their equipment and in meeting any emergency. This type of flying is still so new that techniques or equipment details may change frequently.

While oxygen is often used as low as 12,000ft. as an aid against tiring, the average man can maintain consciousness indefinitely up to about 18,000ft., where the atmospheric pressure is approximately one-half its sea level figure. But his efficiency is much reduced under these conditions. Beyond 18,000ft. complications arise, varying with the individual. Figures given by Boeing indicate that if a man's oxygen supply is cut off at 25,000ft. unconsciousness comes in about three minutes. Above 29,000ft. absence of oxygen means loss of consciousness in less than one minute, with complete coma soon after.

Aeroembolism

Above 35,000ft. an oxygen mask may furnish enough pure oxygen, but the rarefied atmosphere does not supply enough pressure to force the oxygen into the bloodstream. At 40,000ft., a man as active as a member of a crew is breathing with the same difficulty, in spite of his mask, that he would experience at 18,000ft. without a mask.

Thus, with the mask, 40,000ft. seems to be the ceiling of human endurance, and if the limits of high-altitude flight are pushed any higher, it undoubtedly will be done by pressure cabins or pressure suits in which a pressure higher than the surrounding atmosphere can be maintained.

Most important consideration in preparation for high-altitude flight, of course, is physical condition, especially digestion. Foods that cause gas will bring extreme discomfort at high altitudes. Yet the person who chooses not to eat will require more oxygen on the flight. Carbohydrates such as sugar and plain chocolate require the least oxygen in digestion.

In the past, aeroembolism has been the dread of high-altitude flyers—an effect similar to a diver's "bends." To guard aginst this condition, high-altitude flyers to-day "denitrogenise" themselves. Breathing pure oxygen, they exercise mildly for half an hour before a flight, to wash all atmospheric nitrogen out of their blood. Otherwise this gas expands at high altitudes

Mild exercise for 30 minutes before entering the strato-chamber "washes" the nitrogen out of the blood and so prevents aeroembolism when the pressure is reduced.

ALTITUDE EQUIPMENT

into tiny bubbles in the blood-vessels, bringing on the discomfort of aeroembolism.

First used some years ago in developing equipment for the Boeing 307 Stratoliner, the strato-chamber can reproduce flight conditions at altitudes up to 40,000ft., and can accommodate three trainees and their equipment at one time. Vacuum pumps reduce the inside pressure to the equivalent of any desired altitude. Observers outside can watch the progress of the flight through thick windows and communicate with those inside by telephone. Once denitrogenised, and wearing complete flying equipment to become used to the encumbrances, trainees enter the chamber, which has complete oxygen equipment installed. The door is sealed tight, pumps start, and the flyers "ascend" to 35,000ft.

The Turbo-Supercharger

Like most other devices in aeronautics, the exhaust-driven turbo-supercharger is not new, for in 1920 Major R. W. Schroeder flew a biplane so equipped to an altitude of 33,000ft. in U.S.A. This turbo-supercharger had been developed by Dr. Sanford A. Moss, and was successfully tested in September, 1918, on the 14,000ft. summit of Pike's Peak. Mr. E. H. Sherbondy was also another American worker in this field of research and development, and some success was obtained with these superchargers fitted to Liberty engines. Prof. Rateau, in Paris, was simultaneously at work, for the whole scientific world knew of the advantages of the exhaust-driven supercharger—but the trouble was to make it work—at about 700 deg. C.!

Now, thanks largely to metallurgical advances, the turbo-supercharger is in production and is fitted to the Wright Cyclones of the Boeing Fortresses. Fittingly, Dr. Moss is still connected with its development as consulting engineer for the General Electric Company. Retiring from the company in 1938 after 36 years of work, he has now returned at the age of 68 to continue his research.

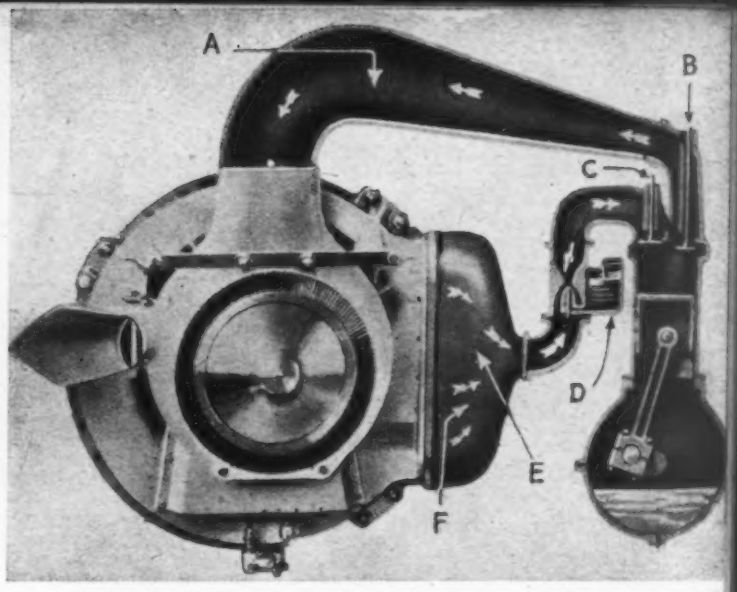


DIAGRAM OF EXHAUST-DRIVEN SUPERCHARGER.
A, exhaust gases from engine to turbine ; B, exhaust valve ; C, intake valve ; D, carburettor ; E, air cooler ; F, compressed air on way to carburettor.

It is the desire for military aircraft which can operate at higher and ever higher altitudes that has forced the development of this type of supercharger for, as altitude increases, so does the advantage of the exhaust supercharger over the gear-driven increase. Though it is not possible to draw hard-and-fast dividing lines between the respective fields of the various types, it seems that for engines with rated altitudes up to about 15,000ft., the gear-driven two-speed supercharger is best because of its installation simplicity. Above a rated altitude of 25,000ft. the exhaust supercharger has no competitor, while between these heights the gear-driven two-stage type with an intercooler fights it out with the exhaust type.

If it were possible to make an infinitely variable gear box, the usefulness of the gear-driven type would probably be raised. Its inefficiency lies in the fact that if it is designed to give maximum unthrottled power at a high altitude, then the manifold pressure which it delivers to the engine at sea level if unthrottled would be so great that the engine could not "take it" and would at least detonate or might even crack the cylinder head by excessive explosion pressure. So at sea level, throttling is necessary and this means loss of power.

These three denitrogenised trainees are in the chamber. They practise handling their masks, parachutes and other equipment as they "ascend." Suction pumps can reduce the pressure to less than one-quarter of that at sea level and solid carbon dioxide is used in the cooling system to lower the temperature to minus 50 or 60 deg. C.

The first all-metal, stressed-skin single-seater fighter, the type 133, was built in 1932 to Air Ministry specification F7/30.

STRESSED-SKIN EVOLUTION

How Research and Experiment Has Resulted in the Bristol Beaufighter

ONE of the first British aircraft firms to institute research into the construction of aeroplanes of the high-performance type, using the metal skin as an integral and important part of the stress-bearing structure, was the Bristol Aeroplane Co., Ltd. Just when the work began is difficult to say, but a great many years ago the Bristol experimental department designed and built a multi-spar test wing of steel. Not only so, but a most elaborate loading jig, with scores of "whipple-trees" for distributing the load in accordance with the calculated air load distribution, was constructed and used in the tests. The wing did not go into production, but it taught the firm some very valuable lessons.

In the early stages a far-seeing policy had to be adopted in order to ensure that the development work should lead to a type of construction which could be applied to a wide range of both commercial and military aircraft. Furthermore, the development had to be such that the same basic forms of construction could accommodate improvements in aerodynamic design, engines of greater power, variations in armament, increases in range, and so forth.

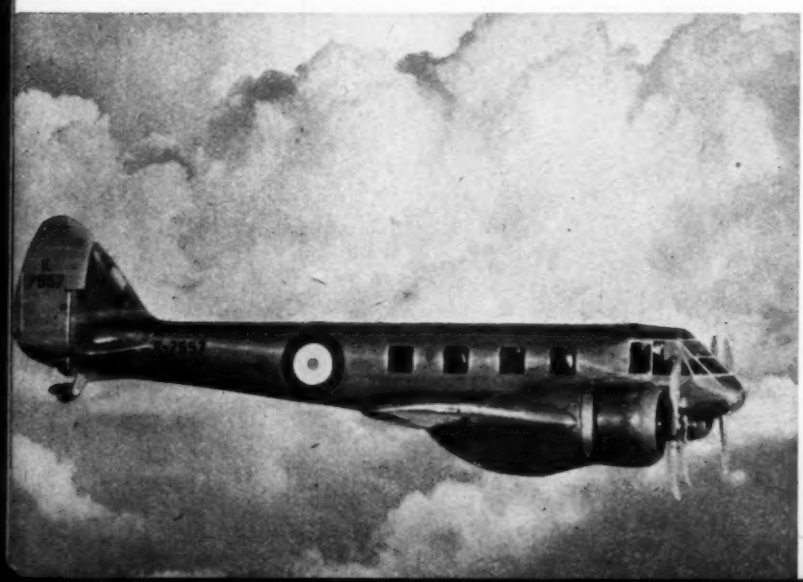
Increases in speed and range make ever-growing demands upon the space inside the aircraft occupied by engines, tanks, cooling systems, and general equipment. The many services driven by the engines require installation of auxiliary systems of hydraulics, pneumatics, electric generators, air pressure and vacuum pumps, de-icing equipment, air cleaning, fire-extinguishing devices, etc. The internal stowage of increasing loads of bombs of varying sizes, mines, torpedoes, and so forth, and the growing number and calibre of fixed and movable guns, with their ammunition, encroach more and more on the available volume of an aircraft These considerations led to light-metal, stressed-skin construction.

Theory and Practice

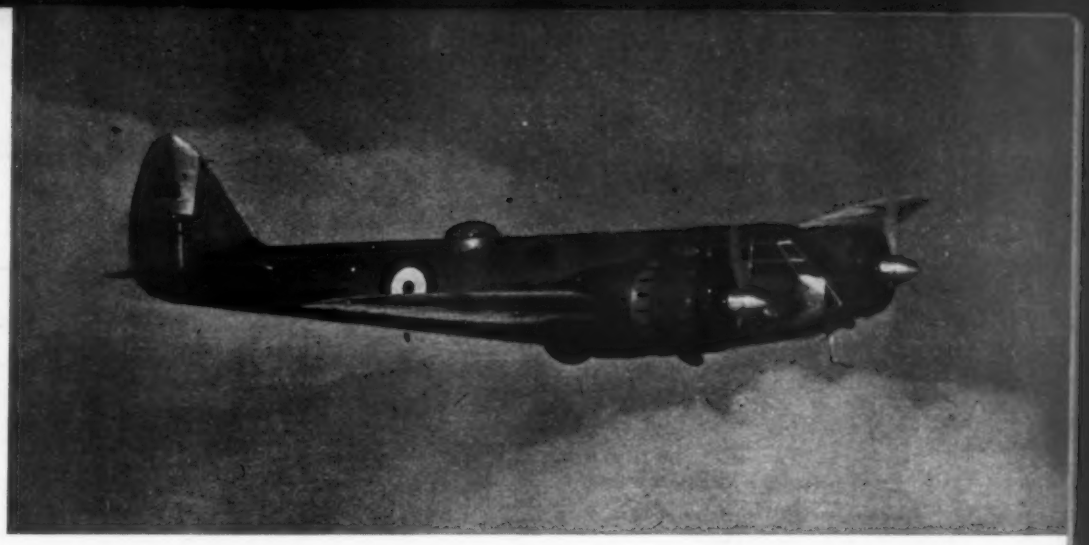
In the Bristol programme of research theoretical investigations were conducted simultaneously with the actual manufacture and strength-testing of specimens, ranging from small panels to complete fuselages and wings. Based upon the results, the fundamental Bristol forms of construction chosen were a two-spar wing with single sheet webs and extruded, rolled or drawn flanges, and for the fuselages a metal skin reinforced by longitudinal stringers attached to simple angle-section formers. The wing construction avoids most of the machining and fitting necessary with built-up braced spars, and the load-filled spaces between spars and in the leading-edge, covered with detachable panels, combine space saving with a remarkable degree of flexural and torsional stiffness.

To meet the need for easy jigging and interchangeability, single pin fittings are used on the main spars for the attachment of the outer wing portions to the main centre-section. The ribs are built as separate units, the skin has longitudinal stringers, and all rivets are accessible on both sides.

The principle of sub-assembly has been adopted whenever possible, and is of considerable value in connection with production, particularly when sub-contract work is widely adopted.



Forerunner of a famous series : The Bristol type 142, "Britain First."



The first Blenheim. This developed into the long-nosed version, and from it were evolved the Beaufort and the Beaufighter.

Parallel problems connected with such devices as retractable undercarriages, landing flaps, and power-operated gun turrets were investigated concurrently, and the fact that they have been solved satisfactorily is proved by the number of Bristol aircraft in service in all parts of the world, where they are giving trouble-free and easily maintained service.

The adaptability of the Bristol methods of construction is shown by the range of types that have been built and in which these methods are employed. Bristols built their first all-metal, stressed-skin single-seater fighter in 1932. At about the same time also appeared the large cantilever monoplane troop-carrier which has since become known as the Bombay. That machine set a new standard, with its ability to lift large loads out of indifferent aerodromes and carry them at high speeds. A third type of about this period was a high-performance, twin-engined, medium-sized aircraft which was destined to be the forerunner of a series of outstandingly successful types in the present war.

The first of these, which did not come into general use in its original form, was a ten-passenger commercial aeroplane. It was powered by two of the first Bristol sleeve-valve engines (the Aquila), had landing flaps and retractable undercarriages, and the engine nacelles were arranged for quick servicing, and for rapid changing of the engines.

The High-speed Era

A similar, but more powerful, version of this type became famous under the name "Britain First." It had Bristol Mercury poppet valve engines and was in its day the fastest commercial aeroplane in the world. For a time this machine was owned by the late Lord Rothermere, and from it was evolved the highly successful military version which has since become famous as the Blenheim. In order to accommodate the bomb load internally, the location of the wing had to be changed from low-wing to mid-wing position, but otherwise the Bristol forms of construction made possible the accommodation of the military load, almost without increase in structure weight.

The Blenheim itself has undergone extensive and varied development, having appeared both in the original form and as a "long-nosed" version. Moreover, it has proved adaptable to many diverse kinds of operation. Its high speed fitted it for the rôle of a highly successful long-range fighter, and its strength enabled it to carry the heavier loads required for longer ranges, armour-plating and increased armament. It has been equipped for night fighting, for high and low altitude fighting (with engines of different altitude ratings), for bombing and for ground strafing. Coastal Command work, reconnaissance and photography are among other duties that Blenheim aircraft have carried out. The type has also been fitted with floats and skis.

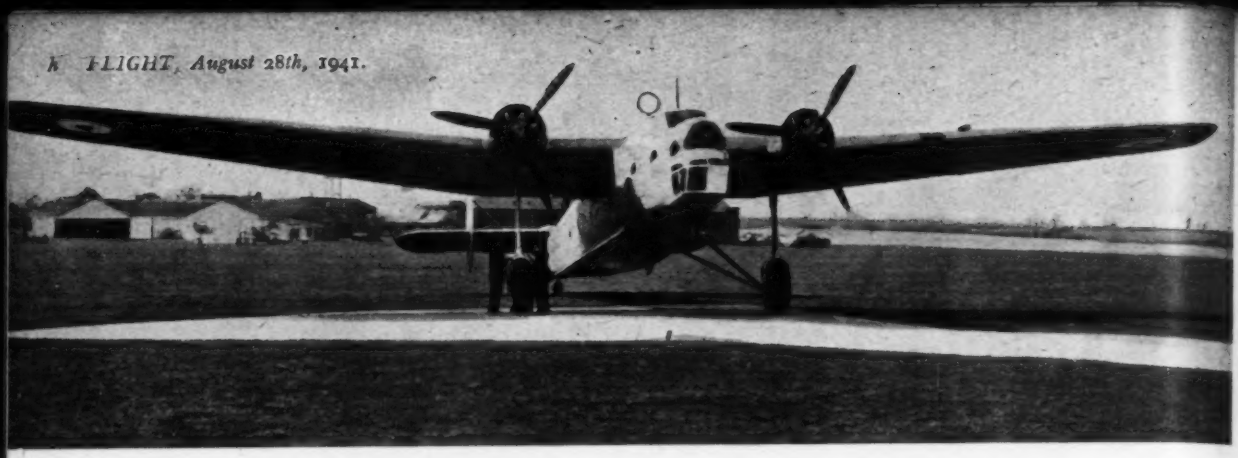
The Beaufort Group

The design of the Bristol Beaufort heralded the introduction of another group of military aircraft which has shown an even more remarkable adaptability to meet varying requirements. The experience gained in design and construction in the Blenheim group made considerable dynamic, structural and manufacturing improvements possible in the Beaufort group. A comparison of the wings of Blenheim I and Beaufort I illustrates this. Although the designed load for the Beaufort I was 80 per cent. greater than that of the Blenheim I, the wing weight was only 14 per cent. greater; while the measured increase in torsional stiffness, a high value of which is essential in monoplane design, was 70 per cent. Furthermore, the Beaufort wings require in production only 50 per cent. of the man-hours of Blenheim wings, both for detailed manufacture and assembly.

The Beaufort is equipped for day and night operation over sea and land, and its duties combine long-range bombing, torpedo carrying, and general reconnaissance. Although the original design gave a range of 1,000 miles with 1,000lb. of bombs, it was soon found possible to increase the range to 1,500 miles and to carry a bomb load of 1,500lb. without loss of performance. With suitable adjustment of range, a bomb load or torpedo up to 2,000lb. in weight can also be carried.

An excellent navigating cabin is arranged under the nose of the Beaufort, which is the ideal station for sea operations. A roomy wireless compartment can take all the equipment

The ten-seater airliner, type 143, had two Aquila sleeve-valve engines.



The Bombay troop-carrier has two Pegasus engines and a non-retracting undercarriage.

called for, and a large supply of all types of flares, etc., can be accommodated in positions where they are easily stowed and used.

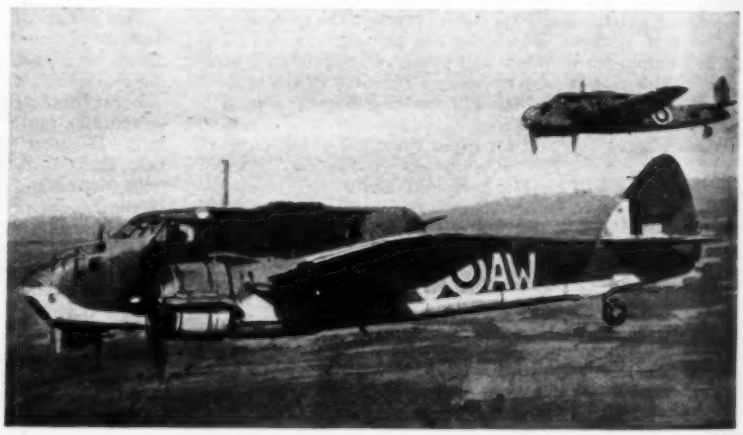
A feature of great value is that winches are built into the aircraft so that no ground equipment is needed for loading bombs or torpedoes. Varying armament can be fitted, with machine guns in the wings, in a hydraulically operated turret amidships, and in an under defence gun position. In spite of the comprehensive equipment carried the design renders it possible for all four members of the crew to change stations in the air with comparative ease.

The Beaufort is fitted with two Bristol Taurus sleeve-valve engines, developing over 1,000 h.p. each, and its high performance and extreme adaptability combine to make even further development of this type desirable.

The unusual structural strength and wing stiffness of the Beaufort suggested the possibility that practically the same machine, but with higher-powered engines and suitably modified fuselage, would make a formidable twin-engined fighter, able to carry the powerful armament required and to withstand the higher diving speeds and loads of this class. The wings are the same as those of Beaufort, and the streamlined fuselage is designed to accommodate a pilot and an observer, who can also attend to the shell-gun armament.

The Beaufighter was described in *Flight* recently, and it will suffice to recall that it is fitted with Bristol Hercules sleeve-valve engines which give it a speed of over 330 m.p.h. for an all-up weight of 20,800lb., compared with 270 m.p.h. and 21,000lb. for the Beaufort.

All types of aircraft in the Beaufort group are particularly suitable for manufacture in the same plant. The constructional methods employed are common to all types, and it can be said, as a rough estimate, that so many parts and components are the same that something like 75 per cent. of the aircraft is shared by all types and can be built with similar tools and equipment. The advantages of this, from a production point of view, are obvious.



The Beaufort (right), designed in the light of experience with the Blenheim, incorporates important structural and aerodynamic improvements.

The Beaufighter (below), is virtually the Beaufort with modified fuselage and engines of greater power (Hercules instead of Taurus).

War in the Air

The Russian Conflict : Ukraine and Leningrad Thrusts : German Shipping Harassed

AGAIN this week chief interest centres on the struggle in Russia, and again the commentator hesitates to generalise because events may falsify his words before they reach his readers. One may, however, say that the third stage of the German offensive seems more formidable than the first two were. The critical point is the Ukraine, where the Germans have captured the port of Nikolaiev, on the estuary of the river Bug, and have became possessed of several Russian warships still on the stocks. They are said to include a battleship, a heavy cruiser and other vessels. German spokesmen say that they can repair these ships, and that when in commission they will completely alter the balance of power in the Black Sea, which is dominated by the Russian Navy. But Russian aircraft have been bombing the slips and hope to prevent their completion. A Russian claim is also made that the ships were destroyed before the place was evacuated.

Another point which is much in doubt at the moment is whether Marshal Budyonny will be able to get the majority of his army safely across the river Dnieper in time. The number of bridges over this formidable river is limited, and the *Luftwaffe* has been trying to destroy them with bombs. We may presume that the Russians have massed A.A. defences round these bridges. Experience has taught us that it is not at all easy to destroy a bridge by bombing. No. 12 Squadron, R.A.F., with its Battles broke the Maastrict bridges, but at the cost of almost complete annihilation of its own machines. In the Spanish civil war there was much comment on the capacity of bridges to survive repeated air attacks—though perhaps the airmen who assailed them were often foreigners who were not full of the do-or-die spirit. The Thames bridges have proved nuts too hard for the *Luftwaffe* to crack, at least by high-flying night bombers. So we need not despair as yet about the chances of Budyonny's retreat.

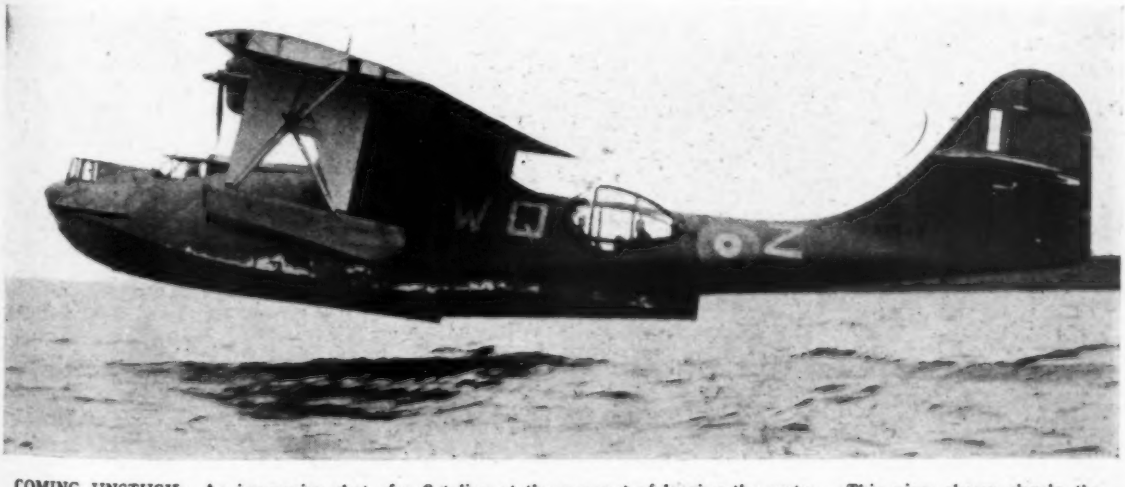
Leningrad Threatened

THE thrust in the north is probably in great part a diversion to prevent a movement of Russian troops southward to reinforce Budyonny, combined with a desire to capture Leningrad before the advent of winter makes military operations impossible. That city, we are told is very strongly defended, and so far it has not been reported that the Germans have sent many bombing raids against it. The Russians will make every effort to hold it, for the city founded by Peter the Great is a great source of national pride; it is an important industrial centre, and, perhaps most important of all, its loss would isolate the naval port of Kronstadt, from which Russian warships have been dealing heavy blows at German shipping.

Communications are one of the chief German difficulties in their invasion of Russia, and it is said that they are using hundreds of transport aeroplanes in the effort to ease the situation. No doubt they are, and for special purposes these large craft can serve a very useful purpose. But one cannot imagine a few hundred of them making any material difference to a battle front which extends for such a prodigious length. Once again there have been reports of tanks being transported in aircraft. In special aircraft something of the nature of a tank, say a machine-gun carrier, weighing not more than five tons, could be transported, or a section of a tank of that weight. In the latter case several aircraft with the various sections would have to land close together, and the tank would have to be designed for rapid assembly in the field. Such a tank might be useful in a few special cases, but it could hardly hope to survive against troops well armed with anti-tank rifles or anti-tank guns. It does not appear probable that any world-shaking victory is to be won by tanks transported through the air.

Enemy Shipping Sunk

THE R.A.F., backed on occasions by the Fleet Air Arm, has been continuing its vigorous offensive both in the northern area of the war and in the Mediterranean. One day lately an offensive sweep was made by many squadrons of fighters, first in the morning and then in the afternoon. The fighters attacked shipping in the harbour at Ostend, and many vessels were hit, one being in a sinking condition when last seen. We may be sure that it was not machine-gun rounds which brought about that result; the installation of shell-guns has made our fighters weapons of attack with a wider range of usefulness than



COMING UNSTUCK : An impressive shot of a Catalina at the moment of leaving the water. This view shows clearly the blister turrets for the rear gunners and the outboard wing floats which are retracted to form the wing tips after take off. This is the actual Catalina which found the *Bismarck* after the surface vessels had lost touch.

WAR IN THE AIR

they had before. Obviously it is more economical to send single-engined single-seaters against light shipping if they will do the work as effectively as twin-engined bombers. The Germans have been relying a lot on coastwise shipping in the Channel of late, and every case of interference with that traffic is good work.

The Admiralty has published the enemy tonnage which it estimates was captured, sunk, or scuttled up to August 16 last. The figures include ships sunk by air attack, and also 51 vessels which the Russians claim to have sunk. The figures in gross tons are:—

German	2,321,000
Italian	1,533,000
Finnish	34,000
Useful to enemy	119,000

On one occasion a fighter off the coast of occupied Europe, either France or the Low Countries, flew rather low over some fishing smacks. The fishermen stood up and held up their oars in the shape of a V.

Good for Malta!

SOME time ago rumours were coming through that there were deficiencies and difficulties about the air defence of Malta, and in fact it must have been a problem to land everything which was really desirable to put those defences in proper shape. For some good while past, however, it has been clear that the difficulties have been overcome, and, in fact, things have been going so well in that gallant and suffering island that the Air Minister, Sir Archibald Sinclair, has sent a message of congratulation to the A.O.C., A.V-M. H. P. Lloyd, M.C., D.F.C., which, incidentally, lets in a good deal of light on the air garrison there. Sir Archibald telegraphed:—

"Heartiest congratulations to you and to all ranks of the squadrons operating under your command on the magnificent success of the air operations from Malta. The brilliant defence of the island by the Hurricanes, the audacious attacks of the Beaufighters on enemy air bases, the steady and deadly slogging of the Wellingtons at the enemy's ports, the daring and dexterous reconnaissances of the Marylands, culminating in the tremendous onslaughts of the Blenheims and Fleet Air Arm Swordfish on Axis shipping in the Mediterranean, are watched with immense admiration by your comrades in the Royal Air Force, and by your fellow countrymen at home. You are draining the enemy's strength in the Mediterranean. Good luck to you, and good hunting!"

AT THE RUSSO-GERMAN FRONT: Junkers Ju 88s with bomb doors open waiting to be bombed up. What a gift such a concentrated target would be to a ground-strafing Russian.

ALL ABOARD: The crew of a Wellington, with all their paraphernalia, go up the ladder into their machine. The hatch is spring-loaded to open inwards and can be used as an emergency exit if the need arises to bale out.

And South Africa!

ANOTHER part of the Empire which has recently received a well-deserved bouquet is South Africa. It will be remembered that in 1919 the first through flight from England to the Union was made by Sir Pierré Van Ryneveldt and Sir Quinton Brand (who were both knighted for their exploit) and that the former stayed in his native country and practically founded the South African Air Force, rising to his present rank of Lieutenant General, while Brand returned to the R.A.F. and is now an Air Vice-Marshal. The South African Air Force celebrated its twenty-first birthday on August 20th, and Sir Quinton broadcast congratulations to it. In the course of his remarks he mentioned that, in addition to the S.A.A.F., which has been fighting so gloriously in East and North Africa, there are about 700 South Africans in the R.A.F. In the present war, up to the date of the broadcast, 76 South Africans have been decorated for valour, 17 of whom are in the S.A.A.F., while the rest are in the R.A.F. A number have received both the D.S.O. and the D.F.C., and at least five of them have bars to one or

WAR IN THE AIR

the other decoration. The most distinguished is Wing Cdr. A. G. Malan, who has been officially credited with 32 enemy aircraft destroyed, and at least 20 others damaged or probables. This record gives him first place, not only among South Africans, but also in the R.A.F.

The Fighting Hudsons

OUT in the Atlantic yet another Hudson has had a successful fight with a Focke-Wulf Kurier, which lasted for 19 min.—quite a long period for an air combat. As the raider approached, both machines jettisoned their bombs and came down low over the water. The Hudson opened fire first at a range of 400 yds. The second pilot was flying the Hudson, so the captain manned one of the side guns, though he had never before fired a shot in action. He said that he was interested rather than excited as the Kurier drew near, and when he was able to let drive with his gun, "that was the best moment of all." Then came the turn of the British rear gunner, an expert at the game, and after he had poured bullets into the enemy the great four-engined machine turned off and used its speed to escape. The relish of these Coastal Command crews for a fight—though their machines were never intended for that sort of activity—fills one with admiration.

Reports from Canberra suggest that Lieut. Gen. Sir Iven Mackay, who commanded the Australian forces in the Libyan campaign, and is now C.-in-C. of the Australian Army, may appear before a secret session of the Commonwealth Parliament to explain remarks he is said to have made about lack of co-operation between the Army and the Air Force in Africa.

ENEMY LOSSES TO AUG. 23rd	Over G.B.	Over Continent	Mid East
Aug 17	1	7	1
,, 18	—	3	1
,, 19	1	14	3
,, 20	—	3	—
,, 21	—	1	2
,, 22	2	2	—
,, 23	—	—	—
	—	—	—
	4	30	7

Totals: Northern Area, 5,255; Middle East, over 2,060

BRITISH LOSSES TO AUG. 23rd	Over G.B. Fighters	Over G.B. Pilots	Over Continent	Mid. East
	—	—	4	—
	—	—	11	2
	—	—	19	3
	—	—	2	—
	—	—	14	3
	—	—	1	—
	—	—	—	—
	—	—	—	—
	0	0	51	8

Totals: Northern Area, 2,541; Middle East, about 367.

AFTER THE WAR

The Churchill-Roosevelt Eight Points Examined, Mainly from the Air Point of View

By MAJOR F. A. de V. ROBERTSON, V.D.

EIGHT points are more digestible than 14 points, and Messrs. Churchill and Roosevelt are to be congratulated on having gone six up (or down?) on the late President Wilson. Very probably the *New York Sun* was right in guessing straight away that the things which the two statesmen said to each other in private were even more important than those contained in the public statement. In fact, that opinion is now very generally held.

The eight points are also in notable distinction from the 14 points in that the latter were published by the head of a nation at war with Germany, whereas the eight points have been agreed upon between one belligerent country and one which is still formally at peace. They gain force from having been drawn up in agreement between the two countries which take the lead in opposing dictatorship and are not the *obiter dicta* of one rather autocratic man.

The principles set forth in the eight clauses are certainly important, but perhaps the time of publishing them is even more important than the matter which they contain. The 14 points were sprung rather suddenly upon the world not long before the final overthrow of the German armies. There was hardly time for them to be digested by either the Allies (the United States was not one of the Allies, but was described as "Associated") or by the Senate and people of the United States. By the time the Treaty of Versailles had been signed the President and Congress of the United States were not in full accord, and the latter declined to confirm the policy which the former had undertaken for the sake of the future peace of Europe. This time the American Congress and people will not be able to complain that they have been given no time to consider the policy which their President has fathered. That by itself augurs well for the future, and one must admire the fine understanding with which President Roosevelt leads

PRESIDENT AND PRIME MINISTER: Mr. F. D. Roosevelt and Mr. Winston Churchill attend divine service on H.M.S. *Prince of Wales*.

AFTER THE WAR

ON BOARD H.M.S. *PRINCE OF WALES* (Left to right): Air Chief Marshal Sir Wilfred Freeman, Vice Chief of Air Staff (G.B.); Gen. Arnold, Chief of Staff for Army Air Corps (U.S.); Admiral Stark, Chief of Naval Staff (U.S.); Admiral of the Fleet Sir Dudley Pound, First Sea Lord (G.B.); Admiral King, Commander-in-Chief Atlantic Fleet (U.S.); Gen. Marshall, Chief of Staff U.S. Army; Gen. Sir John Dill, Chief of Imperial General Staff (G.B.); Admiral Turner, Deputy Chief of Naval Staff (U.S.).

his democracy. If the United States now confirms the policy of the President, that country stands committed to the policy of putting and keeping Europe in order.

No Territorial Aggrandisement

Mr. Churchill is no less responsible for the eight points, and one notices that the policy set forth in them agrees closely with that advised by some of the best political thinkers in this country—among them we may mention Mr. F. A. Voight, editor of *The Nineteenth Century and After*. He has advocated, for example, considerate treatment of Italy, provided that she ceases to menace the peace of other countries, and Clause I of the statement shows that Britain has no desire for the permanent annexation of Eritrea and Italian Somaliland. Ethiopia must, of course, remain free and independent. That is provided for in Clauses II and III. There is every reason why Britain and Italy should be good friends, and only the insensate ambitions of Mussolini have interrupted that friendship. It is to our own interest that reasonable desires on the part of Italy should be satisfied; but she must give up talking about Mare Nostrum and invoking the memories of the old Roman Empire. Likewise she must not maintain a navy or an air force which is obviously intended to drive British interests out of the Mediterranean. It has been proved that Italian ships and aircraft are incapable of bringing about that result, but friendship and threats cannot exist side by side, and so the threats must be eliminated. Those same threats did not concern Britain only; Albania and Greece likewise suffered from them, to say nothing of France—and Italian aircraft played a part in the civil war in Spain. All Mediterranean Powers must be free from the fear of interference by Italy and, once the rule of Mussolini has come to an end, there seems not the slightest reason why the countries bordering that sea should not again live in amity. Hitler may be the embodiment of the spirit of Prussia (Austrian though he is) but Mussolini is anything but the expression of Italian national feeling. Britain is not intending to force Italy to abolish Fascism, any more than she intends to interfere with the internal government of Germany or Russia; Clause III makes that clear. But there is a great difference between the two Dictators in that the one succeeds a string of aggressors who have in turn been enthusiastically followed by the German (or at least the Prussian) people, while the other has forced aggression on a people who by nature prefer to live at peace with their neighbours.

To Live in Freedom from Fear

Clauses VI and VIII envisage the destruction of the Nazi tyranny, the disarming of aggressor nations for as long as may be necessary, and the banishment of fear from the lives of all men. That means first and foremost the disappearance of the *Luftwaffe* as a threatening force. One may wonder now, and perhaps the question will be answered some day when all records are made public, would the tragedy of Munich have come upon the gallant Czechoslovak people, would the humiliation of Munich have been tolerated by France and Britain, if it had not been for the striking power of the *Luftwaffe* and the inability of any other Power to resist it at that time? We know now how weak was France in aircraft, how ill-equipped were our own anti-aircraft batteries and searchlight battalions, and that during the emergency outmoded Gauntlets stood ready on Biggin Hill aerodrome. Events proved that Gladiators could deal with Fiat CR42 biplanes, but the idea of Gauntlets matching themselves against Me 109s and trying to catch He 111s is enough to make one's blood run cold. But, let us not forget, if the Air Ministry can be blamed for not having superseded the Gauntlets by that time, it was the mismanagement of the War Office which was responsible for the deplorable unreadiness of the A.A. defence units. So long as we divide responsibility for anti-aircraft defence between two Ministries we shall always run the risk of a Munich crisis catching us in no sort of shape to resist aggression.

For surprise aggression against an unprepared country there is no doubt that an Air Force is the most dangerous

AFTER THE WAR

instrument. That was proved in Poland and in Holland, not to mention other cases which do not quite fit in with the stated conditions. Therefore, it follows that until the German (Prussian, if you will) people show a change of heart, the Reich must not be allowed to possess any military aircraft. That restriction was imposed in 1918, but it did not prevent the present war. There was, in the inter-war years, and perhaps there always will be, in the British nation a number of amiable sentimentalists who hate to be firm, and who shudder with horror at the idea that we are trampling on a beaten foe. It was that sloppy spirit which inspired the demand to change the name Armistice Day into Remembrance Day. The sentimentalists would allow us to honour our dead, but we must certainly forget that we defeated the Germans and came out victors. Have they disappeared as a result of the present German atrocities? Versailles has been denounced as a cruel treaty, and the infinitely greater harshness of the Treaty of Brest-Litovsk imposed by the Germans on the Russians was conveniently forgotten.

We may be quite certain that the many nations who have been overrun and have suffered the abominations of German rule will not be so quickly mollified. Though British people may (quite probably they will), after their towns have been rebuilt in better form, thank the *Luftwaffe* for getting rid of a lot of slums, we may be sure that the horrors of Warsaw, of Rotterdam, of Belgrade, and of many lesser places will live in the memories of our Allies. But, then, after a war there is almost invariably some wrangling among Allies about reconstruction; and it is characteristic of the British, when feeling somewhat peeved with their late Allies, to blossom into sympathy for their late enemies. That happened after Waterloo, and it happened after Versailles.

Disarming Aggressors is Essential

These thoughts lead naturally to consideration of some words in Clause VIII of the statement. The two leaders of their countries "believe all of the nations of the world, for realistic as well as spiritual reasons, must come to the abandonment of the use of force." There is no fault to find in those words; but, taken out of their context, they may be quoted by pacifists in the future against firm action by the victors and against the retention of armaments by us British. The clause goes on to speak of a "permanent system of general security." It is what every sane man must sigh for, but if those words are used to bring about something so unworkable and ineffectual as the League of Nations they will have done more harm than good. In the mouths of realistic peace-lovers they are admirable, but they may be quoted by pacifists to make easy the Third World War.

The clause ends with the expression of an intention to "aid and encourage all other practicable measures (e.g., in addition to disarming aggressors) which will lighten for peace-loving peoples the crushing burden of armament." Once more we find sentiments deserving of all praise which may become a danger when taken out of their context and used by cranks. With an income-tax at the standard rate of 10s. in the pound, all of us in this country are groaning under "the crushing burden of armament," though we are resolute to arm on until victory is won. After the war is over there will assuredly be a demand for relief, and, of course, there can be no prosperity, no reasonable happiness and enjoyment of life, until this burden has been cut down to a low figure. But until something very much more efficient than the League of Nations is devised, we should be fools to dispense with our insurance premiums. So far, no plan has invalidated the wise old maxim of the Romans—*Si vis pacem, para bellum*.

Even if a new and better League of Nations comes into being, it will have to depend on armed force. Moral suasion has been tried and has failed. There is no prospect of its ever succeeding against a determined aggressor, and nobody can guarantee that no more persons like Edward III, Louis XIV, Napoleon, Frederick the Great, Bismarck, Wilhelm II, Hitler or Mussolini will ever again be born into this world. So, in some way or other, the nations will have to maintain armed forces even under a League of Nations. There certainly were plenty of people who had a hazy idea that if they shouted for the League they would never have to fight themselves. Somebody else, quite undefined, would do their fighting for them, and so it would be quite safe to disarm. Everybody must get that idea completely out of his or her head.

Britain's Necessary Armaments

This is neither the place nor the time to discuss the possibilities of an international force to be held at the orders of the United States of Europe. If the Eight Points stand, then Europe must be knocked into shape and kept in shape by the combined forces of the British Empire and the United States of America for a considerable time to come. It is not too soon to consider what form of armaments Britain must maintain in the new world. Most certainly a Navy; our very life depends on that. In the future we can foresee an amicable division of responsibilities between the Navies of Britain and the U.S.A. That idea began to take shape when Britain gave up the Two-Power Standard and agreed to parity between her naval forces and those of the United States. That idea must be developed, as well as other ideas which will bring the two nations into closer co-operation. An Army? During the period of policing we shall probably have to keep an Army in occupation of some parts of the Continent, and probably some "token" forces from each of the Dominions ought to share in the work. But, in general, Britain's needs are served by a small, very well equipped regular Army, capable of rapid expansion through the agency of the Territorial Army.

The Air Force? *Flight* is naturally most interested in the answer to that question. The Navy will keep its own Air Arm, and the Army certainly ought to have sufficient air squadrons at its own beck and call. It would make for simplicity and efficiency if the Army had its own Air Arm on the same lines as that of the Navy, but at the very least the Army must have first call on a minimum number of squadrons suitable to carry out all the operations required by the generals. Then every sane person will surely agree that the Fighter Command must be kept strong enough to guarantee the integrity of the British Isles against air attack. This Command most certainly ought to be in complete charge of all elements of air defence, the A.A. batteries and the searchlight battalions as well as all such matters as radiolocation. Each Overseas Command must be considered in the light of local conditions.

It is not so easy to lay down what the relative strength of the Bomber Command ought to be. We may start by saying that it must be sufficient to reinforce the Navy or the Army when the need arises. It must maintain its function as a pool or a reserve. But it is more doubtful whether we need to maintain a strong independent striking force. Earlier in the article it was admitted that the threatening existence of the *Luftwaffe* bombers had much to do with bringing about the humiliation of Munich. Do we need a bomber force to keep possibly recalcitrant nations in order? It is not certain. The *Luftwaffe* inspired terror because everybody believed that it would bomb civilian populations. Such a threat would never be part of British policy. The British threat could only concern military targets, and there is still doubt as to whether the effects of such action are rapid enough to act as a deterrent to a nation which was lusting to embark on a career of aggression. It may well be that if our coasts are safe from air attack and our Navy and Army can count on really adequate support from the air, our purposes will be adequately served.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters

ASYMMETRICAL AIRCRAFT

Yet Another Idea

THE idea of "loppy" is excellent and, as an improvement, I suggest a twin-engined, twin-fuselage two-seater fighter in which the pilot sits in one fuselage and the gunner within a turret in the other. The plane is now balanced and, if he likes, the gunner can send his bullets directly forward; the pilot, of course, has his own guns.

"DELTA."

[NOTE.—Our correspondent encloses a sketch from which it appears that the turret guns would have to be synchronised and the pilot's safety from them ensured by limiting the turret movement.—ED.]

ROCKET PROPULSION

Superior Quality of Liquid Fuels

I WAS very interested to find in *Flight*, August 7th last, an article, "Rocket Propulsion," by Dr. F. W. Lanchester. However, I was somewhat surprised when the author drew a comparison between a powder rocket and an ordinary aircraft propelled by a petrol engine and airscrew; and finally stated that, as only a range of 150 miles as compared with 4,000 miles in an ordinary aircraft could be obtained, the rocket has no future.

There are, however, very powerful liquid fuels in existence which, when combined, would produce far greater energies than the powder composition mentioned. For instance, to quote a few, there are liquid oxygn and petrol, liquid oxygen and methane and liquid oxygen and liquid hydrogen. All of these fuels produce, when combined, a foot poundage of some 5,500,000 approximately (officially recorded results) or about 10 times greater than that of T.N.T.

Atomic Hydrogen has been produced, but it has not yet been liquefied. Experiments to this end, however, are now in progress and if they are successful, the energy output is expected to be in the region of 40,000,000 foot pounds—more than ample to propel a rocket far out into space, beyond the attraction of the earth.

Powder fuels are not generally considered practical as once combustion has begun they become uncontrollable. Also, a rocket attains its maximum efficiency at high speeds and at high altitudes. By confining the rocket's speed to that of a typical fighter plane of the present day this efficiency is greatly impaired.

K. W. GATLAND
(Astronautical Development Society).

PICTURE QUERY ANSWERED

Free French Pilot Identifies It

I AM able to give you some information about the damaged aircraft pictured on page 48 of your issue of July 24th.

It is a French dive-bomber of the Aviation Maritime known as Loire 40, built at the Chantiers Loire Penhoët at St. Nazaire.

The same factory built the light reconnaissance flying boat Loire 130 of the French cruisers (which were catapulted), and other flying boats.

The Loire 40 was powered with an Hispano Suiza 12X engine equipped with an H.S. electrically operated V.P. airscrew.

The wings could be folded along the fuselage to allow it to enter the hangars of the aircraft-carrier "Béarn."

The undercarriage as well as the tail wheel was retractable. Instead of diving breaks the undercarriage had to be lowered to check the diving speed.

The Loire 40 carried a 750 kgs. bomb below the fuselage, equipped with an extending arm which prevented the bomb fouling the airscrew. There were two (or four) machine guns in the wings.

The top speed was around 360 k.m.h. at 10,000 feet, and the vertical diving speed with undercarriage lowered 480 k.m.h.

There were two squadrons of Loire 40 on the "Béarn," named AB2 and AB4, the two others, AB1 and AB3, being equipped with Chance Vought dive-bombers.

These squadrons, based at Berks/mer, Boulogne and Lanvéoc Poulmic (Brest), went into action against mechanised units in Northern France and lost nearly all their effectives.

I was in one of the fighter squadrons of the "Béarn" (during the war based at Calais) and flew the Loire 40 several times. It was very easy to pilot and made very good aileron turns during the dive. The triple tail had been added to the original design to prevent vibrations.

About 150 of them had been ordered by the Navy.

"FREE FRENCH PILOT."

DOES MONEY MATTER?

"Indicator's" Viewpoint Challenged

AS one who has read "Indicator's" articles for years with great enjoyment, may I challenge certain of his observations in your issue of August 14th, in which he discusses the question of A.T.A. and R.A.F. salaries under the heading "Does it Matter?"

He certainly sets forth the relative positions in the two Services very clearly and fairly, but he makes one or two observations which, if I may say so, hardly denote clear thinking, though I have not the slightest doubt about his sincerity.

In advancing the view, for example, that "provided that the work is done, it doesn't really matter what anybody is paid," he does not make it clear whether he is referring solely to the R.A.F. and the A.T.A. in wartime, or whether he is putting it forward as a general principle. If the latter is intended, then "Indicator" must possess an altruistic indifference to mere money which, were it a universal attribute of mankind, would solve most of the world's problems overnight. Unfortunately, however, this virtue is so rare that anyone courageous enough (or foolish enough?) to indulge in it can depend upon being enthusiastically exploited by the materialistic majority of his fellows. The theory that scale of remuneration doesn't matter would be all very well in a world composed entirely of altruists, but to apply it in the world as it really is (and always will be, I fear) would be to give *carte blanche* to every kind of exploitation—to throw the door wide open to the war-profiteer and the black-market operator.

"Indicator," I am sure, would be the last to advocate this.

But even if he was referring solely to the question of relative rates of pay in the R.A.F. and A.T.A., I could only agree that the matter is one of no importance if I were convinced that the vast majority of R.A.F. and A.T.A. personnel also took this altruistic view. Frankly, I don't believe any such thing; I believe them to be imbued with the normal human qualities of mankind in general, among whom the question of income is quite important, and that being so, the knowledge that American pilots are being paid considerably more to do precisely the same job as our own A.T.A. pilots must inevitably be productive of a certain amount of envy and discontent—a state of affairs which can hardly increase efficiency or Anglo-American co-operation.

To say that American pilots "have a right to expect anything they can get" because they are "not flying for their own country" is surely a misconception. Since every American, from President Roosevelt downwards (except a few lamentable Lindberghs), knows, and freely agrees, that our war against Hitlerism is also their war, then every American pilot who ferries a bomber across the Atlantic *is* flying for his own country just as much as for Great Britain; and, what's more, he knows it, and, I'm sure, would not wish to deny it.

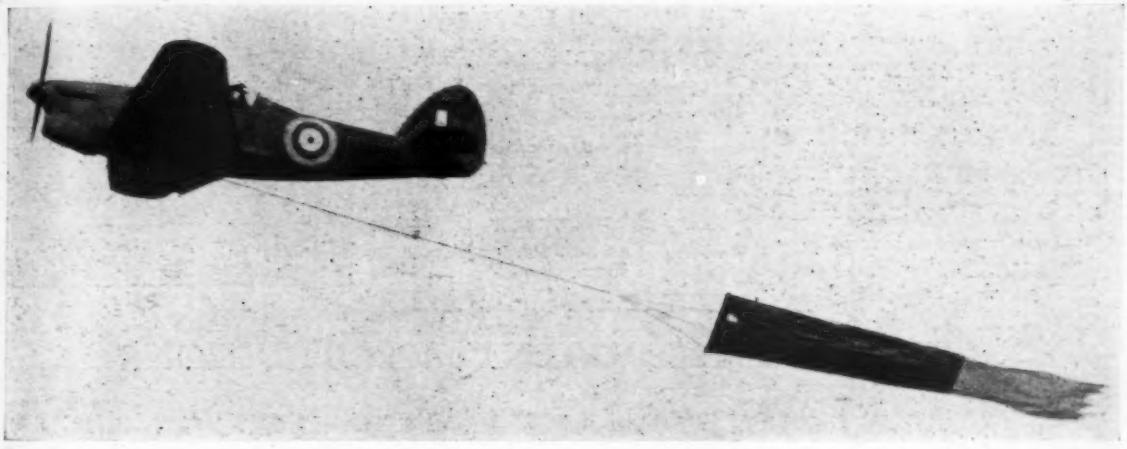
Why, then, should one be paid far more than the other—never mind which side of the Anglo-American partnership happens to be footing the bill?

Since "Indicator" wrote his article, I have read elsewhere that the fantastic sum of £7,250 a year is now being offered to American pilots on the Atlantic ferry, with similarly astronomical rates for second-pilots and navigators. The British Atfero pilot who is doing the job for only a fraction of this princely salary and can view the disparity with indifference must indeed be possessed of wings and halo complete. He is much more likely to be speculating on the chances of acquiring American citizenship for the duration!

"MERCENARY MIKE."

Service Aviation

Royal Air Force and Fleet Air Arm News and Announcements



TARGET-TOWING: A Hawker Henley letting out a sleeve target for A.A. guns to shoot at. Similar targets are used for practising air firing, and there is also a special type which flies offset to the towing machine for use when trying out stern attacks.

THE KING has been graciously pleased to approve the following awards which have been made in recognition of gallantry displayed in flying operations against the enemy:—

DISTINGUISHED FLYING CROSS.

P/O W. C. HARTOP, R.A.F.V.R. (with effect from March 24, 1941).

Act. Flt. Lt. F. D. S. SCOTT-MALDEN, R.A.F.V.R., No. 603 Squadron.—This officer has been continuously engaged in operational flying since June, 1940, leading his flight and sometimes the squadron. During the last six weeks he has taken part in 38 offensive operations over enemy territory. A fine leader, Flt. Lt. Scott-Malden has at all times displayed great keenness and determination in his engagements with the enemy. He has destroyed three and damaged many of their aircraft.

F/O. F. E. G. RASHLEIGH, No. 202 Squadron.—One evening in July, 1941, following a report that one of our aircraft had crashed on the French Moroccan coast, F/O. Rashleigh took off to locate the aircraft and render assistance. Sighting the wrecked aircraft at Sidi Dilemie, he flew low over the spot three or four times, and observed four groups comprising some two hundred Arabs.

While making another circuit, the three members of the crew of the wrecked aircraft detached themselves from the largest group and commenced waving. F/O. Rashleigh indicated that he would land near where they were standing—on the edge of a small undulation. Coming to ground on the shallow side of the rise, out of view of the majority of the Arabs, he finished his run to within thirty yards of the crew, who immediately dashed for the aircraft.

The Arabs then opened fire and F/O. Rashleigh, with the crew scrambling aboard, immediately turned the tail of his aircraft towards the hostile party and opened the throttle, causing a cloud of dust, which obscured them from view. He then took off safely and returned to base with the rescued crew. This officer showed great skill and initiative throughout a daring exploit.

P/O. H. S. SEWELL, R.A.F.V.R., No. 54 Sqn.—This officer has participated in most of the operational sweeps carried out by the squadron. He has displayed great keenness to engage the enemy and has destroyed at least four of their aircraft. P/O. Sewell has set a very fine example.

DISTINGUISHED FLYING MEDAL.

Sgt. W. WHITE deceased (with effect from Oct. 28, 1940).

Sgt. P. A. TANTON, No. 15 Sqn.—In July this airman was the captain of an aircraft which participated in a daylight attack on a factory at Lille. On the approach to the target the outer starboard engine of his aircraft was hit by anti-aircraft fire. Sgt. Tanton continued his run and dropped his bombs with the formation, but later became separated. When nearing the French coast Sgt. Tanton's aircraft was attacked by an enemy fighter who slightly wounded the rear gunner and holed the starboard petrol tank. The inner starboard engine now failed owing to lack of fuel.

In spite of these great hardships, Sgt. Tanton, coolly and skilfully, enabled his rear gunner to engage and shoot down the attacker. Sgt. Tanton then flew on to a home base, where he decided to land. With only the two port engines functioning, the aircraft would not maintain flying speed with the undercarriage or flaps lowered, but, with exceptional skill and judgment, the undercarriage was put down a moment before impact with the ground and a remarkable landing was effected without further damage to the aircraft.

This captain of aircraft displayed splendid skill and coolness throughout and was mainly responsible for the safe return of his aircraft and crew.

THE KING has been graciously pleased to approve the undermentioned awards in recognition of gallant conduct.

MILITARY MEDAL.

Sgt. V. C. CORDERY and Sgt. G. C. STARKEY, R.A.F.V.R. (missing).—In April, 1941, Sgts. Cordery and Starkey were members of the crew of an aircraft which, whilst at its moorings was attacked by a formation of seven Junkers 87s flying in line astern. When the leading pilot dived to make a front gun attack, Sgts. Cordery and Starkey coolly withheld their fire until the enemy was in close range and continued these tactics against the remainder, who attacked at short intervals. During the action, the aircraft was repeatedly hit about the wings, midship section and free gunner's position and on the third attack the inner tanks caught fire and the aircraft rapidly became a mass of flames.

Nevertheless, Sgts. Cordery and Starkey remained at their posts and kept up their fire during the seven attacks and destroyed one of the enemy aircraft and hit others. It was not until further action was impossible that Sgts. Cordery and Starkey left their posts. They were last to leave, and the aircraft sank five minutes later. Both airmen displayed great courage and devotion to duty throughout.

Sgt. W. A. THYNNE and Sgt. E. W. H. ZIETHING.—In May, 1941, Sgts. Thynne and Ziething were, respectively, air gunner and observer in an aircraft which carried out an attack on a fort at Ruthah. After the attack Sgt. Thynne drew the attention of his pilot to an aircraft burning on the ground. A figure waving was seen to be beside the aircraft. The pilot landed alongside and Sgt. Ziething, who jumped out before the aircraft had completely stopped, went to rescue the survivor.

Meanwhile, Sgt. Thynne went to the burning wreckage, where Sgt. Ziething shortly joined him and, in the face of enemy fire from armoured cars and despite ammunition exploding in all directions, both airmen searched the wreckage in an attempt to discover the remainder of the crew. Unable to find any traces of them, Sgts. Thynne and Ziething returned to their own aircraft, which flew off with the rescued officer on board. Both these airmen displayed great courage and complete disregard for their own safety.

Cpl. G. E. BANFIELD.—During the intensive bombardment prior to and during the enemy invasion of Crete, when telephone communication had been destroyed, Cpl. Banfield maintained contact by wireless telegraphy between the station and operations room at Heraklion. For over three days he continued to pass vital information, whilst working in a tent without protection from machine gun fire and bombing. Later, when the unit of some 50 R.A.F. personnel, mainly untrained in fighting, were cut off from the defended area at Heraklion and it became necessary to fight a way through German forces, Cpl. Banfield displayed conspicuous bravery and was always the first to volunteer for any difficult or dangerous task. On two occasions he led small parties in outflanking enemy posts which were keeping the main body under fire, destroying their posts and capturing prisoners.

When the main body were unable to enter our own lines, as our troops failed to recognise them, Cpl. Banfield was the first to volunteer for a small party which succeeded in getting through and warning our troops of the approach of the

Air Commandant K. J. Trefusis Forbes, Director of the W.A.A.F.

SERVICE AVIATION

main body. Cpl. Banfield, by his courageous efforts, contributed materially to the ability of the unit to fight its way through a numerically superior enemy force.

THE KING has been graciously pleased to approve the award of the British Empire Medal (Military Division) to the undermentioned airmen:

Flt. Sgt. R. J. NEWTON.
Flt. Sgt. E. L. BROWN.

Sgt. W. A. THYNNE.—This airman was the air gunner of an aircraft engaged in dive-bombing enemy transport on the Addis Ababa-Dessie road. Following a loud report, a fire was observed along the starboard side of the fuselage. Sgt. Thynne immediately attempted to beat out the flames with his scarf, but was unable to do so. The flames were close to the reserve ammunition and spreading fiercely. Sgt. Thynne secured a fire extinguisher and returned to the fire, which he managed to combat and eventually subdue. It was solely due to the bravery of this airman that the aircraft was saved from destruction. During the operations his right hand was burned and he was wounded in the leg by machine-gun fire.

MENTION IN DESPATCHES (NAVAL).

Sqn. Ldr. E. T. MCKEOWN.
Sgt. G. R. I. PARKER.
Act. Sgt. A. M. WEAVER.
W/O. G. KIRKBY.
Flt. Sgt. R. PIERCY.
Flt. Sgt. A. H. B. STINCHCOMBE.
Sgt. S. CARR.
Sgt. J. K. DIXON.
Cpl. K. J. HOTTLE.
Cpl. G. F. OWENS.
L.A/C. F. HARGREAVES.

COMMENDATION (NAVAL).

W/O. C. R. MARSHALL.

COMMENDATION (CIVIL DEFENCE).

A/C.1 M. L. PATTERSON.

HIS MAJESTY THE KING has granted unrestricted permission for the wearing of the undermentioned decorations conferred on the officers indicated in recognition of valuable services rendered in connection with the War:—

CZECHOSLOVAK MILITARY CROSS OF 1939.

Wing Cdr. Geoffrey Nodun AMISON.
Act. Sqn. Ldr. Percy Charles PICKARD, D.S.O., D.F.C.

Conferred by His Majesty the King of Yugoslavia.

ORDER OF THE WHITE EAGLE, 5TH CLASS.

Flt. Lt. William Patrick GRIFFIN, M.B., B.Ch., R.A.F.O.

NOT A GILDED CAGE: An aircraftwoman of the Balloon Barrage at the winch controls.

AERONAUTICAL PATENT SPECIFICATIONS

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(Published February 13, 1941.)

1939.

19991 RICHARDSON, G. E. Braking devices for vehicles, aircraft and machinery (531,895).
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(Published February 20, 1941.)

1939

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(Published February 27, 1941.)

1938

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1939.

18770 ALBERS, J. R., and ALBERS, G. H. Governors for wind-driven propellers (532,668).
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24639 BARR & STROUD, LTD., and FRENCH, J. W. Sights for guns (532,749).
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(Published March 6, 1941.)

1939.

16384 AIRCRAFT COMPONENTS, LTD., and ARMSTRONG, W. Aircraft alighting-gear (533,076).
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28733 METCALFE, L. E. Airscrew spinners (533,271).

(Published March 13, 1941.)

1939.

13650 VIAZEMSKY, PRINCE S. V. C. Means for discharging bombs from aircraft (533,284).
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29478 FRIEDER, L. P. Suspension cords or shroud lines for parachutes, and method of making the same (533,418).

PUBLICATIONS RECEIVED

Night and Fire Spotting, by Francis Chichester; 2s., George Allen and Unwin, Ltd., 40, Museum Street, London, W.C.1.

Metal Aircraft Construction, by M. Langley; 4th edition, 15s., Sir Isaac Pitman and Sons, Ltd., Parker Street, Kingsway, W.C.2.

Simple Experiments in the Theory of Flight, by M. C. Nokes; 3s., William Heinemann, Ltd., 99, Great Russell Street, London, W.C.1.

Britain Under Fire; Foreword by J. B. Priestley; 6s., Country Life, Ltd., 20, Tavistock Street, London, W.C.2.

Rigging, Maintenance and Inspection of Aircraft ("A" Licence), W. J. C. Speller; 5s., Sir Isaac Pitman and Sons, Ltd., Parker Street, Kingsway, London, W.C.2.

The Battle of Britain, 1940, by J. M. Spaight; 10s. 6d., Geoffrey Bles, 37, Essex Street, London, W.C.2.

Speech Signals in Telephony, by A. Lloyd James; 3s. 6d., Sir Isaac Pitman and Sons, Ltd., Parker Street, Kingsway, W.C.2.

Winged Words; Our Airmen Speak for Themselves; 8s., William Heinemann, 99, Gt. Russell Street, London, W.C.1.

Practical Solution of Torsional Vibration Problems by W. Ker Wilson; Vol. II; 42s., Chapman and Hall, Ltd., 11, Henrietta Street, London, W.C.2.

British Fighter Planes, by C. G. Grey; 5s., Faber and Faber, Ltd., 24, Russell Square, London, W.C.1.

Elementary Mathematics for Wireless Operators, by W. E. Crook; 3s. 6d., Sir Isaac Pitman and Sons, Ltd., Parker Street, London, W.C.2.

The Thin Blue Line, by Charles Graves; 5s., Hutchinson and Co. (Publishers) Ltd., 47, Princes Gate, Kensington, London, S.W.7.

If Hitler Comes, by D. Brown and C. Serpell; 6d., Faber and Faber Ltd., 24, Russell Square, London, W.C.1.

The Complete Air Navigator, by D. C. T. Bennett; third edition, 15s., Sir Isaac Pitman and Sons Ltd., Parker Street, Kingsway, London, W.C.2.

The Observer's Book on Radio Navigation, by W. J. D. Allan; 2s. 6d., George Allen and Unwin Ltd., 40, Museum Street, London, W.C.1

The Aeroplane of Tomorrow, by N. Pemberton-Billing; 12s. 6d., Robert Hale Ltd., 102, Gt. Russell Street, London, W.C.1.

Aerosphere, 1941; 10 dollars, Aircraft Publications, 370, Lexington Avenue, New York City, U.S.A.

Safety in Flight, by Assen Jordanoff; 16s. 6d., Funk and Wagnalls Co. 17, Farringdon Street, London, E.C.4.

The Chairman; Novel by George Vaisey; 8s. 6d., George G. Harrap and Co., Ltd., 182, High Holborn, London, W.C.1.

First Stage Mathematics suitable for the R.A.F. and A.T.C., by A. F. Buchan and R. Borthwick; 2s., University of London Press, Ltd., St. Hugh's School, Bickley, Kent.

Air Navigation, by F. G. Brown; 32s., Chapman and Hall, Ltd., 11, Henrietta Street, Covent Garden, London, W.C.2.

Fire Protection and A.R.P. Year Book for 1941-42; 7s. 6d., Lomax, Erskine and Co., Ltd., Aldwych House, London, W.C.2.